Epidemiology and Clinicopathologic Manifestations of Newcastle Disease in Nigerian Local Chickens

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Key words

Chicken – Newcastle disease – Pathogenicity – Seasonal variation – Nigeria.

Summary

A retrospective study of Newcastle disease (ND) in local chickens diagnosed in the Avian Ambulatory Unit of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria, Nigeria, from January 1978 to December 1997 was conducted. The incidence rate was higher in the dry season with 183 cases (68.4%) against 97 cases (34.6%) in the rainy season out of a total of 280 cases. The study suggested that ND was higher during the dry months of the year possibly because of the harmattan, cold, stress and high wind velocity. The rate was higher in the young with 58 cases (20.7%) against 34 (12.1%) in the adult. There was a statistically significant difference ($p < 0.05$) between ND cases in the dry season and in the rainy season. The Doyle's form of ND had the highest incidence with 106 cases against the Beach's form with 36 cases, the Beaudette's form with 6 cases, and the Hitchner's form that had no case. It was therefore recommended that in producing vaccines against ND, antigens that can stimulate production of a high antibody response against the virulent Doyle's form should be used.

■ INTRODUCTION

The Newcastle disease (ND) is endemic in Nigeria (21). The first documented outbreak of the disease occurred in Ibadan in 1952 (15). Since then, the disease has been the most important disease of chickens in Nigeria (11). ND was reported in exotic and local chickens (1, 12, 13). Currently, the disease is controlled by routine vaccination (11). ND continues to be a serious economic threat to the poultry industry resulting in increased morbidity and mortality rates and loss of eggs for both breeding and human consumption (2, 3, 16, 19).

Village chickens according to Martin (18) are free-ranging poultry, mostly unimproved indigenous breeds. A high proportion of households in the village keep such birds and the flock size generally ranges from a few to up to 100 birds. In village poultry the occurrence of ND is dependent on a combination of factors. The presence of the pathogenic strain of ND is a factor which is necessary for the disease to develop, but it is not in itself the cause. This is because village poultry populations are mixed in terms of susceptibility to infection with the Newcastle disease virus (NDV) because of immunity due to age and exposure to NDV and because of extreme conditions, the spread of the virus from bird to bird does not occur as readily as in intensely housed poultry (18).

The major disease affecting village chickens around the world is ND, and it generally appears in its severest form, often killing 100% of birds (8). ND is enzootic within individual regions and even villages. There was serological evidence of NDV infection in Nigerian local chickens, and a prevalence of about 4% was recorded (4). In Nigeria, local indigenous chickens constitute about 92% of the total chicken population of 134 million. It is believed that virulent NDV is kept in circulation by these local chickens (4). Because of the introduction of susceptible birds through hatching and the probability that some flocks or individuals will have evaded infection during the passage of the disease through the poultry population in the village, it is possible

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that within the village poultry population, there will always be susceptible birds to which diseased birds will transmit NDV (18).

The introduction of NDV to a village most likely occurs when infected live chickens are introduced. Live bird markets are probably a major means of spread (5, 7), particularly since many village owners take birds to markets as soon as they become sick, in an attempt to recuperate something.

Other means of introducing new strains of ND to a village poultry population include wild birds, live infected chickens being transported through the village, infected carcasses, and movement of objects from infected site. Cases of contaminated vaccines have also occurred (5).

Spread by the fecal/oral route is slower than by the respiratory route. Chickens infected with NDV shed the virus in the feces and the infection can become established following its ingestion. This means of spread is important particularly for low virulence viscerotropic strains (18). NDV can survive in feces, on eggshell, on feathers, on walls and other inanimate objects, and in water. In each of these situations, the virus is more resistant to inactivation when it lasts more than a day or two; it can survive many days in ponds and lakes full of organic material. Sick and dead birds are often eaten by flock owners and viscera from birds for the table are often fed to poultry. The combination of these two practices provides an excellent opportunity for ND to spread (18).

There are four forms of the disease caused by different strains of the virus: the Doyle's form, Beach's form, Beaudette's form and Hitchner's form. In the Doyle's form all ages are susceptible. Morbidity may reach up to 100% and mortality is very high, usually 90% (9). In the Beach's form, morbidity is also high and mortality variable. A 10% mortality in the adult is very common though it may be higher. Among immature chickens, mortality is as high as 90%. Mortality in the adult in the case of the Beaudette's form is rare and morbidity is variable (10). The Hitchner's form of the disease has negligible death losses although in young birds especially, when complicated with other infectious diseases, the mortality rate can reach 30% (10).

The simplest and most logical measure against ND and other infections is to prevent contact of the virus with susceptible birds and also to perform vaccinations. Vaccinations give the birds a greater or older degree of protection against infection in case of exposure (6). A combination of sanitary measures to prevent or reduce exposure and of vaccination are often required to control highly contagious diseases such as ND (6). Specific immunity against ND develops within a week of age or older. All individuals in a flock may not develop a substantial immunity as the immunity may wane considerably two to six months after vaccination, and revaccination may be done to increase immunity (6).

This paper examines the incidence of ND in village chickens reported in the Poultry Health Unit of the Veterinary Teaching Hospital over a period of twenty years with the aim of determining the clinical and pathological forms of the disease that are frequent, determining the seasonal distribution of ND, so that an effective vaccination program can be set up as well as the time for administration of these vaccines in this locality.

■ MATERIALS AND METHODS

Clinical records of the Avian Ambulatory of the Veterinary Teaching Hospital were consulted from January 1978 to December, 1997. Most of the chickens were brought to the clinic from Samaru and its vicinity for confirmatory diagnoses. Postmortem examinations were also conducted on dead birds and appropriate samples taken for microbiological evaluation.

Clinical records were collected as follows: date, case number, flock size, age, number of morbidity cases, number of mortality cases, number presented, history and clinical signs, postmortem changes and treatment recommended. All cases of ND in local chickens were used for the study.

The pathotypes of ND in village chickens were studied based on the classification by Brandly (6). These clinicopathologic forms of ND were studied and tabulated under six headings: the Doyle's form, Beach's form, combined Doyle and Beach's forms, Beaudette's form, Hitchner's form, and those for which no postmortem lesion was reported in the clinical records.

The effect of the season and age of birds on the epidemiology of ND in village chickens was analyzed and tabulated. The following season effects were considered: dry season (January-March), prerainy season (April-June), rainy season (July-September), and predry season (October-December).

The following age groups were considered: young (birds of 1 day to 147 days), adults (birds of 148 days and above), various ages (those that were reported by the clients to be of mixed ages, both young and adults growing together), and unknown age (those whose clinical records did not indicate any age group).

The data were arranged into tables with respect to frequency of ND with non-ND cases, and to season, age, monthly and yearly distribution. The Chi-square test was used to determine whether or not a significant relationship existed between the incidence of ND and the season (17).

■ RESULTS AND DISCUSSION

The Doyle's form of ND had the highest incidence (Table I) with 106 cases (37.9%), followed by the mixed Doyle and Beach's forms with 80 cases (28.6%). The Beach's form had 36 cases (12.9%) and the Beaudette's form only 6 cases (2%). No case was recorded for the Hitchner's form, not necessarily because this form of the disease does not occur in local chickens in this community but because it is a mild and inapparent clinical form in chickens and a rare cause of mortality in birds.

The Doyle's form still remained a threat to village chicken production in this locality. ND cases were higher in the dry season (Table II) with 183 cases (65.4%) out of a total of 280 cases against 97 cases (34.6%) in the rainy season. The results also showed that the difference between ND in the dry season and in the rainy season was statistically significant ($P < 0.05$). This observation corresponded with that of Saidu et al. (20) on the seasonality of ND, which revealed that ND occurs between October and March (with the incidence highest between January and March), which is the harmattan period when there is extreme cold and wind. It is suggested that the high incidence of ND in these months may be due to the influence of high wind velocity, high amounts of dust, cold and stress worsening the outcome of the infection.

The study also showed that ND occured year round in the village poultry production (Table III), with the highest cases recorded between November and March, and December having the highest number (43 cases), followed by January (41 cases). This study showed that ND was at its peak during the dry months of the year possibly because of the harmattan, cold, stress and high wind velocity. Values of odds ratios (OR) equally indicated a higher incidence in the dry months.

The significance of this result is that vaccination against ND should be intensified in the months preceding the beginning of the dry season, that is between August and September, later doses could be administered in the dry season (January to March).

Table IV reveals that out of 280 cases of ND registered, 58 (20.7%) occurred in the young, 34 (12.1%) in adults, 116 (41.4%) in mixed ages and 72 cases (25.7%) in a history of unknown ages.

Comparing young and adult cases, the authors observed that ND had a greater chance of occurring in the adults. Chickens became increasingly resistant to ND with age. The low rate of incidence in the adult could be the result of the immunity induced by previous exposure or vaccination (18).

However, flocks of various age groups had the highest number of ND cases. This could be due to the fact that there is a continuous cycling of infection between the adult and the young as they grow together. According to Martin, 1991 (18), village chickens are a mixed population in terms of immunity to ND. Chicks become capable of developing an immune response.

As long as adults are allowed to move and mix with the young, there is always a greater possibility of the young becoming infected with ND in the absence of control measures by vaccination and proper hygiene.

This work also showed that 126 (45%) out of the 280 cases of ND diagnosed in Zaria over a period of 20 years were concurrent with other diseases. These diseases included: ectoparasitism, trauma,

Table I

Yearly distribution of the Newcastle disease according to clinicopathologic forms

Year	D	BC	MX	BD	HC	UN	Total
1978-1982	a	a	a	a	a	a	0
1983	b	b	b	b	b	b	0
1984	2	b	4	b	b	1	7
1985	5	2	3	b	b	3	13
1986	5	1	10	1	b	10	27
1987	15	12	9	1	b	5	42
1988	11	3	11	1	b	4	30
1989	10	5	8	1	b	15	39
1990	23	4	8	1	b	6	42
1991	12	3	10	1	b	3	29
1992	5	b	b	b	b	1	6
1993	2	1	b	b	b	4	7
1994	6	3	7	b	b	b	16
1995	5	1	4	b	b	b	10
1996	1	b	2	b	b	b	3
1997	4	1	4	b	b	b	9
Total	106	36	80	6	0	52	280

D: Doyle's form; BC: Beach's form; MX: Doyle and Beach's forms; BD: Beaudette's form; HC: Hitchner's form; UN: Diagnosis in which there were neither clinical signs nor postmortem lesions

a: no case records

b: no case reported

Table II

Seasonal distribution of Newcastle disease (ND) cases with other diseases over a 20 year period in local chickens

Season	Subseason	ND	Non-ND cases
Predry	87	155	
Dry	96	147	
Total dry season		183	302
Prerainy	56	194	
Rainy	41	194	
Total rainy season		97	388
Overall total		280	690

Table III

Total monthly distribution of Newcastle disease (ND) cases with other diseases over a 20 year period

	ND cases	Non-ND cases	Monthly total	Monthly specific rates (%)	OR	95% CI on OR lower bound	95% CI on OR upper bound
January	41	55	96	43	1.84	1.198	2.817
February	33	46	79	42	1.77	1.107	2.823
March	22	46	68	32	1.18	0.696	1.996
April	17	49	66	26	0.85	0.484	1.510
May	17	54	71	24	0.78	0.442	1.362
June	22	91	133	17	0.60	0.366	0.969
July	15	71	86	17	0.52	0.293	0.924
August	10	70	80	13	0.35	0.179	0.693
September	15	53	68	22	0.70	0.387	1.258
October	17	40	57	30	1.05	0.584	1.878
November	26	60	86	30	1.07	0.660	1.727
December	45	55	100	45	1.92	1.263	2.939
Total	280	690	970				

OR: Odds Ratios

CI: confidence interval

Table IV

Distribution by age of Newcastle disease (ND) cases and other diseases in local chickens

Age group	ND cases	Non-ND cases	ND specific rates	OR	95% CI on OR lower bound	95% CI on OR upper bound
Young	58	166	26	0.88	0.633	1.22
Adult	34	43	42	1.81	1.330	2.89
Mixed (various)	116	334	26	0.87	0.676	1.12
Unknown	72	139	34	1.29	0.939	1.77
Total	280	690				

OR: odds ratio
CI: confidence interval
ND: Newcastle disease

Gumboro disease, chronic respiratory disease, infectious sinusitis, vitamin A deficiency, and kerosene poisoning.

Generally, village flocks are affected by a range of poultry diseases (8). Nutrition is often poor in birds dependent on scavenging for limited quantity of available food. This predisposes birds to a wide range of diseases; postmortem examination may conclude that the cause of death was ND, but there are usually other concurrent infections. Hence in controlling ND, efforts should be made towards controlling other diseases.

■ CONCLUSION

This paper showed that the Doyle's form (viscerotropic-velogenic) of ND was the most prevalent in local chickens in Zaria, Nigeria. Therefore, in producing vaccines against ND, antigens that can stimulate the production of a high antibody response against this virulent form should be used. Also, even though ND occurs year round, it has the highest incidence in the dry season. Vaccination should be intensified prior to that period so that in case of outbreaks, the mortality will be lower. Finally, in controlling ND efforts should also be made towards controlling other diseases, such as the Gumboro disease, helminthosis, chronic respiratory disease, ectoparasitism, etc., because of the issue of concurrent infections.

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Résumé

Manchang T.K., Abdu P.A., Saidu L. Epidémiologie et manifestations clinicopathologiques de la maladie de Newcastle chez des poulets de race locale nigérians

Une étude rétrospective a été menée sur la maladie de Newcastle (MN) diagnostiquée chez des poulets de race locale dans le service ambulatoire aviaire du Veterinary Teaching Hospital, à l'université d'Ahmadu Bello, Zaria, Nigeria, entre janvier 1978 et décembre 1997. Sur un total de 280 cas, le taux d'incidence de la MN a été plus élevé pendant la saison sèche avec 183 cas (68,4 p. 100) que pendant la saison des pluies avec 97 cas (34,6 p. 100). Les résultats ont suggéré que le taux de la MN était plus élevé pendant la saison sèche peut-être en raison de l'harmattan, de la force du vent, du froid et du stress. Le taux a été plus élevé chez les jeunes avec 58 cas (20,7 p. 100) contre 34 (12,1 p. 100) chez l'adulte. La différence entre les cas de MN pendant la saison sèche et pendant la saison des pluies a été significative ($p < 0,05$). La forme de Doyle de la MN a été la forme qui a eu la plus grande incidence avec 106 cas, contre 36 cas pour celle de Beach, 6 cas pour celle de Beaudette et aucun cas pour celle de Hitchner. Ainsi, il est recommandé d'utiliser des antigènes qui peuvent stimuler la production d'une forte réponse des anticorps contre la forme virulente de Doyle, lors de la production de vaccins contre la MN.

Mots-clés : Poulet – Maladie de Newcastle – Pouvoir pathogène – Variation saisonnière – Nigeria.

Resumen

Manchang T.K., Abdu P.A., Saidu L. Epidemiología y manifestaciones clínico-patológicas de la enfermedad de Newcastle en los pollos de raza local nigerianos

Se llevó a cabo un estudio retrospectivo sobre la enfermedad de Newcastle (EN), diagnosticada en pollos de raza local en el servicio ambulatorio aviar del Veterinary Teaching Hospital, en la Universidad de Ahmadu Bello, Zaria, Nigeria, entre enero 1978 y diciembre 1997. De un total de 280 casos, la tasa de incidencia de la EN fue más elevada durante la estación seca, con 183 casos (68,4%), que durante la estación lluviosa, con 97 casos (34,6%). Los resultados sugieren que la tasa de EN fue más elevada durante la estación seca, quizá debido al harmatan, a la fuerza del viento, al frío y al estrés. La tasa fue más elevada en los jóvenes, con 58 casos (20,7%), contra 34 (12,1%) en el adulto. La diferencia entre los casos de EN durante la estación seca y durante la estación lluviosa fue significativa ($p < 0,05$). La forma de Doyle de la EN fue la forma con mayor incidencia, con 106 casos, contra 36 casos para la de Beach, 6 casos para la de Beaudette y ningún caso para la de Hitchner. Se recomienda utilizar los antígenos que pueden estimular la producción de una respuesta fuerte de anticuerpos contra la forma virulenta de Doyle para la producción de vacunas contra la EN.

Palabras clave: Pollo – Enfermedad de Newcastle – Patogenicidad – Variación estacional – Nigeria.