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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

Retrospective (2000-2009) Study of Newcastle Disease (ND) Cases in Avian Species in Maiduguri, Borno State, North Eastern Nigeria

M.A. Sadiq¹, J.A. Nwanta², E.C. Okolocha³ and A.N. Tijjani¹

¹Department of Animal Health and Production, Mohamet Lawan College of Agriculture, P.M.B. 1427, Maiduguri, Borno State, Nigeria

²Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Nigeria Nsuka (UNN), Nsuka, Nigeria

³Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria

Abstract: A case-control study on Newcastle Disease (ND) in avian species was conducted using ten year (from January 2000 to December 2009) clinic records of the avian Clinic of the ultramodern Veterinary Hospital Maiduguri. A total of four thousand six hundred and forty seven (4647) with mean of 38.40 ± 4.391 (Mean \pm SE) cases of various diseases of avian species were presented to the ultramodern veterinary hospital Maiduguri within the ten year period. Out of these cases ND accounted for 2427 (52.23%), from which 811 (17.5%) were male while 1616 (34.7%) were female avian species. Local fowls (L/Fowls) accounted for 755 (46 \pm 9) of all the cases, of which 459 (60.8%) were ND cases. Out of 1293 (74 \pm 14) cases in layers 740 (57.2%) were ND while from 709 (27 \pm 5) cases recorded in broilers, ND accounted for 268 (37.8%). A total of the 186 (10 \pm 2) cases recorded in turkeys, 99 (53.2%) were ND. Out of the 26 (2 \pm 0) cases in peacocks, 10 (38.5%) were ND. A total of 76 (4 \pm 1) cases recorded in ducks, 19 (25.0%) were ND while out of 46 (3 \pm 1) cases in geese, ND accounted for 5 (10.9%) cases. From 753 (45 \pm 7) cases in cockerels, 447 (59.4%) were ND. From the total of 106 (6 \pm 1) cases recorded in ostriches, 61 (57.5%) were ND. Out of 7 (2 \pm 0) cases in African crowned cranes (Cranes), 3 (42.9%) were ND while from 91 (1 \pm 0) cases in pigeons, ND accounted for 7 (7.7%) cases. Out of 575 (31 \pm 6) cases of guinea fowl (G/Fowls), 306 (53.2%) were ND cases; out of 24 (2 \pm 0) cases in psittacines, 3 (12.5%) were ND cases. The distribution of ND among flock size of various avian species showed that flock size 1-50 had 623 (13.40) cases, 51-100 had 548 (11.79%); 101-150 had 595 (12.80%) while flock size 151 and above had 661 (14.22%) cases. Newcastle disease among age groups of various avian species showed that birds within the age range of 0-9 weeks had 718 (15.45%), 10-19 weeks 958 (20.61%), 20 weeks and above 412 (8.86%) while 339 (7.29%) cases were birds of unknown age. In the year 2000, 144 (56.7) ND cases were recorded among various avian species, 99 (49.0%) 2001 while 95 (48.2%) in 2002. In the year 2003, 243 (56.2%) cases were ND, 271 (52.7%) in 2004, 265 (46.0%) in 2005, 470 (66.7%) in 2006, 355 (51.2%) in 2007, 242 (35.1%) and 243 (62.9%) in 2008 and 2009 were ND cases respectively. Seasonal peaks of ND cases were shown to occur in January, November and December while the trend for other months showed relative stability.

Key words: Newcastle disease, retrospective study, avian species, Maiduguri, Nigeria

INTRODUCTION

Newcastle Disease (ND) is an acute, mild to severe, highly infectious and pathogenic disease of domestic poultry, caged and aviary birds as well as wild birds caused by specified viruses of the Avian Paramyxovirus Type I (APMV-I) (Kianizadeh *et al.*, 1999; Alexander, 2003). Although the first outbreaks recognized as Newcastle disease occurred in Indonesia in 1926, it has been suggested that a large outbreak in Scotland in 1896 was due to Newcastle Disease Virus (NDV). The disease was named for a large outbreak that occurred in Newcastle, England in 1927 (American Veterinary

Medical Association [AVMA], 2006). About 8000 species of birds seem to be susceptible to infection with Newcastle Disease Viruses (NDVs) (Kaleta and Baldauf, 1988). The natural hosts of NDV are domestic poultry, including chickens, turkeys, ducks, geese, pigeons, quail, pheasants, guinea fowl and ostriches and many species of captive caged birds and wild birds (Alexander, 2000). In most species of bird the young are more susceptible than the adult (Arnall and Keymer, 1975). A wide range of avian and non-avian species act as reservoirs of NDV and transmit the disease to susceptible birds (Roy *et al.*, 1998). The first

documented confirmed outbreak of NCD in Nigeria occurred between December 1952 and February 1953 in and around Ibadan (Hill *et al.*, 1953). In Nigeria, NCD was reported to be the most prevalent disease of local and exotic birds (Abdu *et al.*, 1985; Saidu *et al.*, 1994; Halle *et al.*, 1999). In Nigeria, the virus has been isolated from natural infection in captive African grey parrot (*Psittacus erithracus*) (Onunkwo and Momoh, 1980). In Zaria, ND was reported to be the most prevalent disease of local and exotic birds (Abdu *et al.*, 1985; Saidu *et al.*, 1994; Halle *et al.*, 1999). Outbreaks of ND were reported to be more likely in farms that kept exotic birds together with local chickens and other poultry species like ducks and turkeys (Abdu *et al.*, 2005b). The outbreaks of ND were more common in layers than in broilers (Abdu *et al.*, 2005b). Newcastle Disease (ND) is the most important disease and it causes very high mortality (Sonaiya, 2009). The disease was also reported to be more common during the dry harmattan (November-March) (Saidu *et al.*, 1994; Halle *et al.*, 1999; Abdu *et al.*, 2005a; Sonaiya, 2009). Cold stress has been known to worsen the outcome of ND (Abdu *et al.*, 1992). ND in Nigeria has age and species differences (Halle *et al.*, 1999; Abdu *et al.*, 2005a). In rural Nigeria, it is common to find a combination of different poultry species and breeds being kept in the same compound (Ibrahim and Abdu, 1992), including chickens, turkeys, Muscovy ducks and pigeons. At present it is customary to find ostriches, peacocks, geese and mallard ducks in the same compound in cities and in some poultry farms (Alexander, 2001; Adene and Oguntade, 2006; Friend, 2006). In Nigeria ND was reported in guinea fowls and a highly velogenic strain of ND virus was isolated from apparently healthy ducks (Echeonwu *et al.*, 1993). Most research works on the prevalence of ND were centered on domestic chickens. In nature various species of poultry are kept together in households. Even in commercial poultry production other species are kept along with domestic chickens. It has been reported that susceptibility of these species to ND varies with some serving as reservoirs for disease spread. Following the outbreak of Highly Pathogenic Avian Influenza (HPAI) in Nigeria in 2006, the poultry sector has suffered a tremendous setback. Efforts are now geared towards resuscitation of the sector. However ND outbreaks and its consequent economic losses hinder the effort to revive the poultry industry. Newcastle disease continues to decimate various poultry species which are commonly kept within the households and farms. The findings of this study will provide a base line data on the ND status of various avian species. This information will be of assistance in the management and control of the disease.

MATERIALS AND METHODS

A case-control study was conducted using ten year (2000 to 2009) clinic records of the avian Clinic of the

ultramodern Veterinary Hospital Maiduguri. Clinic records of the avian Clinic of the Veterinary Hospital Maiduguri was studied from January 2000-December 2009 to determine the effects of species, flock size, age, sex and season, on outbreaks of ND. Information on ND was extracted from the clinic record and all non-ND cases was considered in a group as, "other avian diseases," cases were diagnosed based on history, clinical signs and post-mortem lesions observed at the necropsy department of the veterinary hospital, as adjudged by the clinicians. Newcastle disease cases are those avian species presented with the clinical signs of gasping, stretching of neck, sneezing, coughing, tracheal rales, circling, in-coordination, weakness or paralysis of legs and wings, profuse yellowish green or whitish diarrhoea, ruffled feathers, depression and dehydration. And/or those avian species that presented post-mortem lesions of Congestion and mucous exudates in the trachea; congestion of the lungs; haemorrhages of the mucosa of the proventriculus; haemorrhagic and necrotic ulceration of lymphoid patches of the intestine, caecal tonsils and bursa of Fabricius and congested ovarian follicles in laying birds.

The age groups of birds were categorized as follows: (i) 0-9 weeks old (ii) 10-19 weeks old (iii) 20 weeks and above and (iv) Unknown age. Birds were categorized according to the species of the birds, i.e. Local Fowls (L/Fowls), layers, broilers, cockerels, guinea fowls (G/Fowls), ducks, geese and game birds; ostrich, peacock, African crowned cranes (Cranes), pigeons and Psittacines. The flock sizes were arranged in following ranges: (i) 1-50, (ii) 51-100, (iii) 101-150, (iv) 150 and above flock size. SPSS-13 statistical software was used to analyze data collected. The prevalence (%) and seasonal decomposition using centered moving averages were performed to determine trend. Statistical associations between season, age, specie, flock size, on outbreaks of ND were tested.

RESULTS

A total of four thousand six hundred and forty seven (4647), 38.40 ± 4.391 (Mean \pm SE) cases of various diseases of avian species were presented to the ultramodern veterinary hospital Maiduguri within the ten year (from January 2000 to December 2009) period. Out of which ND accounted for 2427 (52.23%), from which 811 (17.5%) were male while 1616 (34.7%) were female avian species (Table 1).

Table 2 below showed that from the total of 2427 ND cases in avian, the distribution of ND among flock size of various avian species shows that flock size 1-50 had 623 (13.40), 51-100 had 548 (11.79%), 101-150 had 595 (12.80%) while flock size 151 and above had 661 (14.22%).

Table 1: Ten year (2000-2009) species specific distribution of ND cases by sex among avian species

Bird spp.	Total No. of cases (Mean±SE)	ND cases and prevalence (%)	Sex and prevalence (%)	
			Male	Female
L/Fowl	755 (46±9)	459 (60.8)	127 (16.8)	332 (44.0)
Layers	1293 (74±14)	740 (57.2)	0 (0.0)	740 (57.2)
Broilers	709 (27±5)	268 (37.8)	103 (14.9)	165 (23.7)
Turkey	186 (10±2)	99 (53.2)	32 (17.2)	67 (36.0)
Peacock	26 (2±0)	10 (38.5)	4 (15.4)	6 (23.1)
Ducks	76 (4±1)	19 (25.0)	5 (6.6)	14 (18.4)
Geese	46 (3±1)	5 (10.9)	1 (2.2)	4 (8.7)
Cockerels	753 (45±7)	447 (59.4)	447 (59.4)	0 (0.0)
Ostrich	106 (6±1)	61 (57.5)	15 (14.2)	46 (43.3)
Crane	7 (2±0)	3 (42.9)	1 (14.3)	2 (28.7)
Pigeon	91 (1±0)	7 (7.7)	2 (2.2)	5 (5.5)
G/fowl	575 (31±6)	306 (53.2)	73 (12.7)	233 (40.5)
Psittacine	24 (2±0)	3 (12.5)	1 (4.2)	2 (8.3)
Total	4647 (38.40±4.391)	2427 (52.23)	811 (17.5)	1616 (34.7)

Table 2: Ten year (2000-2009) species specific rates of ND cases among flock size of avian species

Bird spp.	Total No. of cases (Mean±SE)	ND cases and Prev. (%)	Flock size of birds affected and prevalence (%)			
			0-50	51-100	101-150	151 and abv
L/Fowl	755 (46±9)	459 (60.8)	111 (14.7)	168 (22.3)	130 (17.2)	50 (6.6)
Layers	1293 (74±14)	740 (57.2)	132 (10.2)	143 (11.1)	207 (16.0)	258 (19.9)
Broilers	709 (27±5)	268 (37.8)	44 (6.2)	64 (9.0)	63 (8.9)	97 (13.7)
Turkey	186 (10±2)	99 (53.2)	99 (53.2)	0 (0.0)	0 (0.0)	0 (0.0)
Peacock	26 (2±0)	10 (38.5)	10 (38.5)	0 (0.0)	0 (0.0)	0 (0.0)
Ducks	76 (4±1)	19 (25.3)	19 (25.3)	0 (0.0)	0 (0.0)	0 (0.0)
Geese	46 (3±1)	5 (10.9)	5 (10.9)	0 (0.0)	0 (0.0)	0 (0.0)
Cockerels	753 (45±7)	447 (59.4)	77 (10.2)	99 (13.2)	114 (15.1)	157 (20.9)
Ostrich	106 (6±1)	61 (57.6)	61 (57.6)	0 (0.0)	0 (0.0)	0 (0.0)
Crane	7 (2±0)	3 (42.9)	3 (42.9)	0 (0.0)	0 (0.0)	0 (0.0)
Pigeon	91 (1±0)	7 (7.7)	7 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
G/fowl	575 (31±6)	306 (53.2)	52 (9.0)	74 (12.9)	81 (14.1)	99 (17.2)
Psittacine	24 (2±0)	3 (12.5)	3 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)
Total	4647 (38.40±4.391)	2427 (52.23)	623 (13.40)	548 (11.79)	595 (12.80)	661 (14.22)

Table 3: Ten year (2000-2009) species specific rates of ND cases among age groups of avian species

Bird spp.	Total No. of cases (Mean±SE)	ND cases and Prev. (%)	Age of birds affected and prevalence (%)			
			0-9	10-19	20 and abv	Unknown
L/Fowl	755 (46±9)	459 (60.8)	112 (14.8)	191 (25.3)	95 (12.6)	61 (8.1)
Layers	1293 (74±14)	740 (57.2)	242 (18.7)	285 (22.0)	113 (8.7)	100 (7.7)
Broilers	709 (27±5)	268 (37.8)	150 (21.2)	113 (15.9)	0 (0.0)	5 (0.7)
Turkey	186 (10±2)	99 (53.2)	20 (10.8)	47 (25.3)	12 (6.4)	20 (10.8)
Peacock	26 (2±0)	10 (38.5)	0 (0.0)	2 (7.7)	1 (3.9)	7 (26.9)
Ducks	76 (4±1)	19 (25.3)	0 (0.0)	2 (2.6)	9 (11.8)	8 (10.5)
Geese	46 (3±1)	5 (10.9)	0 (0.0)	0 (0.0)	2 (4.4)	3 (6.5)
Cockerels	753 (45±7)	447 (59.4)	143 (19.0)	177 (23.5)	98 (13.0)	29 (3.9)
Ostrich	106 (6±1)	61 (57.5)	3 (2.8)	6 (5.7)	19 (17.9)	33 (31.1)
Crane	7 (2±0)	3 (42.9)	0 (0.0)	0 (0.0)	0 (0.0)	3 (42.9)
Pigeon	91 (1±0)	7 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)	7 (7.7)
G/fowl	575 (31±6)	306 (53.2)	48 (8.4)	135 (23.5)	63 (10.9)	60 (10.4)
Psittacine	24 (2±0)	3 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (12.5)
Total	4647 (38.40±4.391)	2427 (52.23)	718 (15.45)	958 (20.61)	412 (8.86)	339 (7.29)

Out of the total of 2427 ND cases in avian, the distribution of ND among age groups of various avian species shows that birds within the age range 0-9 weeks had 718 (15.45%), 10-19 weeks 958 (20.61%), 20 weeks and above 412 (8.86%) while 339 (7.29%) were birds of unknown age (Table 3).

The highest ND prevalence of 66.7% was recorded in 2006 while the lowest prevalence of 35.1% was obtained in 2008 (Table 4). Seasonal decomposition using centered moving average revealed seasonality in the trend of ND among various avian species presented to the avian clinic of the ultramodern veterinary hospital

Table 4: Number and year specific rates (%) of ND cases among avian species

Year	Total number of avian cases (Mean±SE)	No. and prevalence (%) of ND cases
2000	254 (21.17±1.878)	144 (56.7)
2001	202 (16.83±1.167)	99 (49.0)
2002	197 (16.42±1.459)	95 (48.2)
2003	432 (36.00±1.674)	243 (56.2)
2004	514 (42.83±2.367)	271 (52.7)
2005	576 (48.00±9.432)	265 (46.0)
2006	704 (58.67±6.889)	470 (66.7)
2007	693 (57.75±8.958)	355 (51.2)
2008	689 (57.42±8.574)	242 (35.1)
2009	386 (32.17±3.289)	243 (62.9)
Total	4647 (38.4±4.391)	2427 (52.2)

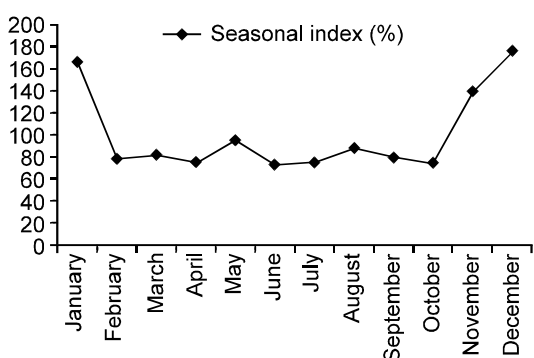


Fig. 1: Ten year seasonal trend of Newcastle disease by ratio to moving average plot

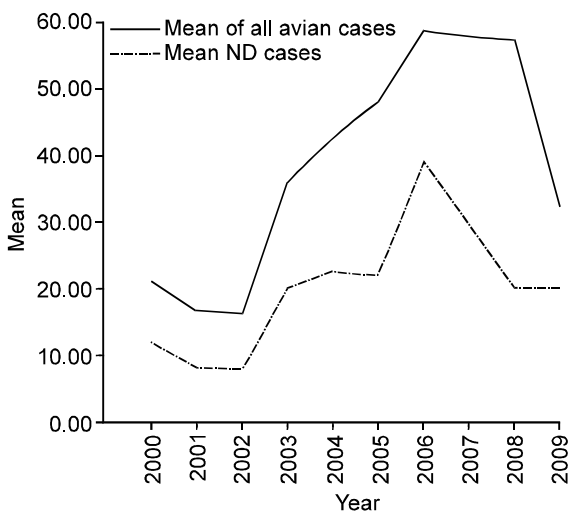


Fig. 2: Mean annual distribution of all cases and ND cases in avian species

Maiduguri. Seasonal peaks were shown to occur in January, November and December while the trend for other months showed relative stability (Fig. 1). Figure 2 shows mean annual distribution of ND with lowest mean annual occurring in 2002 and peak mean annual ND cases occurring in 2006.

DISCUSSION

Newcastle disease is an important infectious disease of avian species. The prevalence of ND in this study was 52.23% this was lower than 73.0% (Ezeokoli *et al.*, 1984) and 74.3% (Nwanta, 2003) in Kaduna. The prevalence in this study was also lower than 63.0% reported by Orajaka *et al.* (1999) in the south east derived savannah zone of Nigeria and 54.0% reported by Baba *et al.* (1998) in Maiduguri. The difference in prevalence could be due to the fact that the present study was based on retrospective study of clinical cases while those studies were based on serological prevalence. The prevalence in this study was higher than 41.0% reported by Abdu *et al.* (1985) in Plateau state, 38.0% by Oyewola *et al.* (1996) in Ibadan Oyo state. This difference in prevalence could be as results of those studies were focused on domestic chickens only while in this study all avian species were considered. Although all sexes of avian species are equally susceptible to ND the prevalence in this study was more 34.7% in female than 17.5% in male birds. This is consistent with the findings of Tadesse *et al.* (2005) who reported the prevalence of 31.63% and 32.63% in males and females respectively seroprevalence study of Newcastle disease in local chickens in Central Ethiopia. The prevalence of 60.8% in local fowls, 57.2% in layers and 37.7% in broilers obtained in this study were lower than 99.9% of 812 outbreaks in chickens in Zaria recorded by Sa'idu *et al.* (2006). The prevalence in this study was also lower than 92% seroprevalence in local fowls obtained by Sa'idu *et al.* (2004) and 95% in layers and 75% in broilers reported in Pakistan by Ullah *et al.* (2004). The prevalence was higher than 51.9% in layers, 26.3% in broilers and 20.6% in local chickens reported by Abdu *et al.* (2005a). Prevalence of 53.2% recorded in turkeys in this study was lower than 68% reported by Sa'idu *et al.* (2004). In this study the prevalence of 57.2% obtained in ostriches was higher than 12.2% in a seroprevalence study of ND in ostriches in Japan reported by Sakai *et al.* (2006). The prevalence of 38.5% recorded in peacocks, 25.0% in ducks, 10.9% in geese and 53.2% in guinea fowls obtained in this study was lower than 76%, 44.0%, 32.0% and 76.0% in peacock, ducks, geese and guinea fowls respectively in study of seroprevalence reported by Sa'idu *et al.* (2004). The prevalence in ducks and guinea fowls were higher than 6.7% and 13.6% in ducks and guinea fowls respectively reported by Mai *et al.* (2004). The differences in prevalence could be due to difference in study methodology where those studies were based on seroprevalence while the present study was based on retrospective analysis of clinical cases. The flock size specific rates vary among the different species or types of birds. In local fowls the highest prevalence of 22.3 was recorded within the flock size 51-100, 17.2% within flock size 101-150 and 14.7% in flock size 1-50, this was lower than 46.7% in birds of flock size 1-50, but higher than 1.6% in flock size >300 obtained in Zaria by Sa'idu

et al. (2006). In layers and boilers the flock size specific rates increases with increase flock size. This increase in the prevalence in these types of bird may be attributed to the increased susceptibility to NDV of commercial birds (layers and broilers) made up of exotic breeds unlike more resistant local breeds. This is consistent with the findings of Oluyemi *et al.* (1979) who stated that village (local) chickens are more resistant than exotic chickens. The distribution of prevalence of ND were recorded only in birds of flock size 1-50 among peacocks 10 (38.5%), geese 5 (10.9%), ostriches 61 (57.6%), African crowned cranes 3 (42.9%) and psittacines 3 (12.5%). This could be attributed to the fact that these birds are kept by individuals, in small flocks of 1-4, as a symbol of status.

The prevalence of 15.5% recorded among birds of age group 1-9 weeks in this study was slightly higher than 13.3% obtained by Sa'idu *et al.* (2004) in birds of 1-5 weeks age group. The highest prevalence of 20.6% was recorded in birds of 10-19 weeks age group, this finding was also slightly lower than 24.35% recorded in birds of age group 11-15 weeks. The lower prevalence in age group 1-9 weeks could be due to presence of maternal antibodies present in that group while the increase in prevalence witnessed in the age group 10-19 could be attributed to waning out of the maternal antibodies in this age group. This is consistent with the findings of Nwanta *et al.* (2006) who reported that young domestic fowls and guinea fowls are more commonly affected by ND than adults. The increased prevalence in this age group of local and guinea fowls could be attributed to the fact that they are seldom vaccinated against ND by local farmers, while in layer it could be due to environmental stress coupled with stress of egg production. Likewise poultry farmers engaged in cockerel production in most cases do not complete vaccination schedule against ND. More or less all ages of different species of birds are susceptible to ND, although substantially less with advancement to maturity (Alexander, 2001).

There is steady up surge in total number of cases and ND cases presented to the avian clinic of veterinary hospital Maiduguri from 2006 through 2008. This could be attributed to the public enlightenment drive on the dangers of recent outbreak of Highly Pathogenic Avian Influenza (HPAI) H5N1, where farmers are advised to report any suspected avian disease for investigation. In this study ND was shown to occur through out the year, nevertheless, the seasonal trend showed that peaks of the disease occurred in January, November and December which coincides with the dry season months. This finding was similar to the findings of Saidu *et al.* (1994; 2004), Abdu *et al.* (1992) and Halle *et al.* (1999). According to Abdu *et al.* (1992) these months fall within the dry harmattan period which is characterized by wind and cold. The slight increased ND cases in May could be due heat stress as a result of increased in environmental temperature while that of August could result from occasional cold stress resulting from heavy

down pour associated with this month. Based on the above findings in this study it can be concluded that the prevalence of ND among avian species in Maiduguri Borno state, North Eastern Nigeria was 52.3%. The prevalence of ND with increased flock size and the distribution of ND among flock size of various avian species. The seasonal trend of ND in this study revealed the occurrence of peak outbreaks in November, December and January. Vaccination of all bird species before these periods may aid in prevention of outbreaks during these periods. There is the need for public enlightenment, especially those engaged in poultry farming and individuals keeping pet/game birds, on the economic importance of ND to the poultry industry. Birds of different species and ages should be segregated while newly acquired birds should be quarantined and observed for signs of ND for at least 30 days. There is the need to introduce and sustain routine vaccination of both chickens and other pet/game birds e.g. peacocks, cranes, geese, ostriches and psittacines coupled with the provision of adequate effective and affordable thermostable vaccine (NDV₁₂ or NDV₄) against ND.

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