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FIRST EVIDENCE OF CANINE DISTEMPER VIRUS IN DOMESTIC CATS IN PLATEAU STATE, NIGERIA: IMPLICATIONS FOR CROSS-SPECIES TRANSMISSION

Kenneth Ikejiofor Ogbu[a*], Enoch John Gagara[a], Ijeoma Chekwube Chukwudi[b], Maimadu Audu Abdullahi[c], Jibreel Abdullahi Sabo[d], Maikasua Hasan Ahmed[c], Kingkey Uwakwe Ezema[e] Matthew Terzungwe Tion[f]

[a]Department of Animal Health, Federal College of Animal Health and Production Technology, National Veterinary Research Institute Vom, Plateau State, Nigeria
[b]Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Nigeria Nsukka, Enugu State, Nigeria
[c]Department of Veterinary Laboratory Technology, Federal College of Animal Health and Production Technology, Vom, Plateau State, Nigeria
[d]Department of Public Health, Federal College of Animal Health and Production Technology, Vom, Plateau State, Nigeria
[e]Veterinary Teaching Hospital, University of Maiduguri, Borno State, Nigeria
[f]Department of Veterinary Medicine, College of Veterinary Medicine, Federal University of Agriculture, Makurdi, Benue State, Nigeria

[*]**Correspondence:** drken2016@gmail.com; ogbu.kenneth@fcahptvom.edu.ng; +2348030852357; ORCID: 0000-0003-0924-1604

ABSTRACT

Canine distemper (CD) is a highly contagious viral disease that affects domestic dogs and various wildlife species, including ferrets, raccoons, and cats. It is a highly infectious, systemic, viral disease that occurs worldwide in the susceptible hosts. It is caused by the canine distemper virus (CDV), a member of the Morbillivirus genus in the Paramyxoviridae family. This disease is often fatal and affects multiple body systems, including the respiratory, gastrointestinal, and central nervous systems. The aim of the study was to detect canine distemper virus in domestic cats in Plateau Central Senatorial Zone. Thirty fecal swab samples were randomly collected from domestic cats in the study area and labeled appropriately, transported in cooler contain ice parked to Veterinary clinic Side laboratory, Federal College of Animal Health and Production Technology, Vom. The data from the study were analyzed using Chi-square test methods. Out of the 30 samples, 14(46.67%) were positive for CDV in domestic cats. Out of 30 samples for males were 6(46.15%) while for females was 8(47.6%) though not statistically significant. The occurrence was higher in female than male (P=0.62). The animals were categorized into three age groups: those less than 1 year the occurrence was 3(37.5%), 1-2 years were 7(53.33%) and 2 years were 4(40.0%). Though not statistically significant, the occurrence was found to increase with age (P=0.576). It is recommended that CD should be considered in cats in cases of related clinical signs. This is the first report of Canine distemper investigation in domestic cats in Nigeria based on available data.

This research provided relevant information on canine distemper in domestic cats which may help cats owner and update researchers of its spread.
Key words: Canine distemper virus, Antigen, Domestic cats, Plateau State, Nigeria

Introduction

Canine Distemper is a pantropic worldwide infectious disease caused by canine distemper virus (CDV), a member of the genus *Morbillivirus* within the family *Paramyxoviridae*. CDV is an enveloped virus and has a non-segmented negative-stranded RNA genome (Del Puerto *et al.*, 2010). Clinically, CD is characterized by diphasic fever, leukopenia, gastrointestinal and respiratory catarrh, frequently pneumonia and often, neurologic complications. The disease occurs in a wide range of domestic and wild animal species, including *Carnivores* (dogs, foxes, and wolves), *Mustelidae* (ferret, mink, and skunk), *Procyonidae* (raccoon, coatimundi) *Ailuridae* (red panda), *Ursidae* (bear) *Elephantidae* (Asian elephant), *primates* (Japanese monkey) *Felidae* and some *Viveridae* (binturong) (Gaskin, 1974; Greene and Appel, 1990; Cook and Wilcox 1981; Qui and Mainka 1993; Appel and Montali, 1994; Appel *et. al.,* 1994; Deem *et. al*., 2000; Ogbu *et al.,* 2025). Many of these wild animals serve as reservoirs for maintaining the virus in the canine population where there is direct or indirect contact with domestic dogs, however, it is puzzling how the disease continues to persist in domestic dogs in urban communities where there is high level of vaccination and little contact with potential wildlife reservoir hosts. Despite extensive vaccination in many regions, canine distemper remains a major disease of dogs worldwide. Epidemics have occurred in dog populations in isolated areas where the disease had been absent for several years (Greene and Appel, 2006; Duque-Valencia *et al,* 2019). One possibility is that the virus is maintained in the canine population through a constant supply of puppies that provides susceptible populations for infection (Greene and Appel, 2006). The other possibility is that dogs imported (or straying) from other communities bring the virus.

Vaccination has been used widely for the control of CD, however, during the last decade**,** sporadic reports of reemergence of CDV has become commonplace, and there is anecdotal evidence that the number of CD cases has increased as much as four- to fivefold in dogs in the last few years despite extensive vaccination (Kapil *et al*., 2008). It is estimated that 25% to 75% of dogs susceptible to CD are infected sub-clinically and are transmitting the virus without showing clinical sign of disease (Greene and Apple, 2006). Such asymptomatic dogs are not diagnosed and may be important CDV reservoirs.

The disease occurs in a wide range of domestic and wild animal species, including Carnivores (Domestic cats, foxes, and wolves), Mustelidae (ferret, mink, and skunk), Procyonidae (raccoon, coatimundi) Ailuridae (red panda), Ursidae (bear) Elephantidae (Asian elephant), primates (Japanese monkey) Felidae and some Viveridae (binturong) (Gaskin, 1974; Cook and Wilcox 1981; Greene and Appel 1990; Qui and Mainka 1993; Appel and Montali 1994; Appel *et. al*., 1994; Deem *et. al*., 2000; Ogbu *et al.,* 2025). Many of these wild animals serve as reservoirs for maintaining the virus in the canine population where there is direct or indirect contact with domestic domestic cats, however, it is puzzling how the disease continues to persist in domestic domestic cats in urban communities where there is high level of vaccination and little contact with potential wildlife reservoir hosts. Despite extensive vaccination in many regions, canine distemper remains a major

disease of domestic cats worldwide. Epidemics have occurred in domestic cats' populations in isolated areas where the disease had been absent for several years (Greene and Appel, 2006). One possibility is that the virus is maintained in the canine population through a constant supply of kittens that provides susceptible populations for infection (Greene and Appel, 2006; Wipf *et al*., 2025). The other possibility is that Domestic cats imported (or straying) from other communities bring the virus. Vaccination has been used widely for the control of CD, however, during the last decade, sporadic reports of reemergence of CDV has become commonplace, and there is anecdotal evidence that the number of CD cases has increased as much as four- to fivefold in Domestic cats in the last few years despite extensive vaccination (Kapil *et al.,* 2008). It is estimated that 25% to 75% of Domestic cats susceptible to CD are infected sub-clinically and are transmitting the virus without showing clinical sign of disease (Greene and Apple, 2006; Duque-Valencia *et al,* 2019). Such asymptomatic Domestic cats are not diagnosed and may be important CDV reservoirs. It is therefore essential to investigate canine distemper virus occurrence in asymptomatic Domestic cats populations, especially as it is thought that contact among clinically or sub-clinically infected Domestic cats may be the main method of maintaining the virus within the Domestic cats population (Greene and Apple, 2006), the objective of the study described here is to evaluate normal Domestic cats in the Makurdi area for evidence of infection with canine distemper virus.

Canine Distemper (CD) is a pantropic worldwide infectious disease caused by canine distemper virus (CDV), a member of the genus *Morbillivirus* within the family Paramyxoviridae. CDV has an enveloped virion containing a non-segmented negative-stranded RNA genome, which comprises approximately 16 Kilobases (Kb). Six genes encode for a single envelope-associated protein (M), two glycoproteins (the hemagglutinin H and the fusion protein F), two transcriptase-associated proteins (the phospho-protein P and the large protein L), and the nucleocapsid protein (N) that encapsulates the viral RNA (Moss & Griffin, 2006). The H gene protein is used for attachment to receptors on the cell in the first step of infection, and an adequate host immune response against the H protein may prevent CDV infection (von Messling *et al.*, 2001). After attachment, the F protein promotes fusion of the viral envelope with the host cell membranes, and also promotes membrane fusion between the host cells, with formation of syncytia (Lamb *et al*., 2006). The M protein links ribonucleoproteins with envelope proteins during various assembly, and the P protein regulates transcription, replication, and the efficiency with which the nucleoprotein assembles into nucleocapsids (Moss & Griffin, 2006). The nucleocapsid gene is considered a conserved region among different CDV strains, while H gene is subjected to higher genetic and antigenic variation than other CDV genes, the amino acid sequence vary by approximately 10% among different CDV strains (Martella *et al*., 2008).

Variable clinical signs may be present, making the clinical diagnostic difficult (Appel & Summers, 1995). Contact among infected (clinic or subclinical) domestic cats maintains the virus within the domestic cats population (Greene & Apple, 2006), mainly kittens (3-6 mths) who are susceptible to infection, due to the loss of maternal antibodies (Krakowka & Koestner, 1976). However, canine distemper is also a common disease in adult Brazilian domestic cats (between 1 and 9 years old) and corresponds to the main cause of death in domestic cats within this average age (12.4%) (Fighera *et al.,* 2008).

Several laboratory tests are available to confirm clinical CDV infection; however, most of the commonly used tests may not be sensitive, specific, and quantitative enough to detect subclinical infection. Immuno fluorescence (IF) on conjunctival, nasal, and vaginal smears can detect CDV antigens only within 3 weeks after infection, when the virus is still present in the epithelial cells (Appel, 1987), but it has low sensitivity and can generate false negative diagnoses. Virus isolation on cell lines from clinical samples is fastidious. ELISA assay may detect high antibody titers to CDV for several months after vaccination or after subclinical or clinical infection, turning false positive results (Martella *et al*. 2008). Molecular assays, such as RT-PCR (Frisk *et al*., 1999; Kim *et al*. 2001; Rzezutka & Mizak 2002; Gebara *et al*., 2004) are sensitive and specific, but not quantitative.

Canine subclinical infection by CDV contributes to the spread of the disease, requesting the development of a more sensitive diagnostic technique for early detection and quantification in asymptomatic animals and in those with subclinical infection. The quantitative real time PCR technique has been used for CDV detection and quantification in blood samples, conjunctive swabs, urine, and tissues in Domestic cats showing clinical signs of disease, and also in infected VERO cells (Elia *et al.,* 2006; Scagliarini *et al.* 2007).

There is paucity of reports on canine distemper in felids in Nigeria despite its pantropic nature, devastating effects and polyxenous nature of CDV hence the study.

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Material and Method

Study Design

A cross-sectional study was carried out to evaluate the canine distemper viral antigen in cats in Plateau Central Senatorial Zone

Sample Collection

Fecal swab samples were randomly collected from domestic cats and were labeled appropriately, then packed in cooler contain ice parked and immediately transported to Veterinary Clinic Side laboratory, Federal College of Animal Health and Production Technology Vom, Plateau State.

Sample Analysis

The samples were analyzed using a rapid CDV antigen kit (SensPERT® Canine Distemper Test Kit, VetAll Laboratories, Gyeonggi-do, Korea), for detection of CDV antigen according to the manufacturer's instructions. This kit is a chromatographic immunoassay for the qualitative detection of CDV antigen in canine faeces. Firstly, a faecal swab was collected par rectum and was dipped into the diluents. The mixture was stirred evenly. Four (4) drops of supernatant from extracted sample were added into the sample hole. As the test begins to read, purple coloration moved across the result window in the center of the test device. The test results were interpreted within 5-10 minutes (Esfandiari & Klingeborn, 2000).

Data Analysis

The data from the study were presented in table and expressed in percentages. Comparison between the factors such as sex and age, of domestic cats were analyzed using chi-square test methods.

Results

A total number of 30 domestic cats were sample from November to December 2020. Out of the 30 samples, 14(46.67%) were positive for CDV in domestic cats

Incidence of CDV Based on Sex

Out of 30 samples, males were 6(46.15%) while females were 8(47.6%) though not statistically significant, the occurrence was higher in female than male (P=0.6.26)

Table 1: Incidence of CDV based on Sex

Variable	No examined	No positive	% Occurrence	P-value
Male	13	6	46.15	
Female	17	8	47.06	0.626
Total	30	14	100	46.67

Incidence of CDV Based on Age

The animals were categorized into three age groups: less than 1 year, the occurrence was 3(37.5%); 1-2 years were 7(53.33%) and those of 2 years were 4(40.0%). Though not statistically significant, the occurrence was found to increase with age (P=0.576)

Table 2: Incidence of CDV based on Age

Variable	No examined	No positive	% Occurrence	P-value
< 1 year	8	3	37.5	
1-2 years	12	7	53.33	0.576
> 2 years	10	4	40.0	
Total	30	14	100	46.7

Discussion, Conclusion and Recommendations

Canine distemper virus (CDV) is a pantropic morbillivirus with a worldwide distribution (Beineke *et al*., 2015) affecting most mammals including domestic and wild species of dogs, coyotes, foxes, pandas, wolves, ferrets, skunks, raccoons, and cats, as well as pinnipeds, some primates, and a variety of other species (Sattler *et al*., 2014). Unlike the related measles virus which is maintained by single host species, CDV represents a rather promiscuous agent causing distemper-like pathology in a variety of different carnivorous and also non-carnivorous species (Frölich *et al*., 2000; Deem *et al*., 2000; Baumgärtner *et al*., 2003). Clinical findings and pathology resemble largely the disease in dogs. However, morbidity and mortality may vary greatly among animal species (Beineke *et al*., 2015). The detection of CDV antigen from fecal samples of domestic cat from the study area is a confirmation the report of Ikeda *et al.* (2011) who reported the presence of CDV antibodies in domestic cat in Asia. Although in felids, CDV can cause clinically silent infections or fatal disease (Beineke *et al*., 2015; Ogbu *et al.,* 2025), there are no reports of naturally occurring systemic CDV infections, despite frequent contact with dogs. Experimental infection of domestic cats with a highly virulent CDV strain resulted in asymptomatic infection without virus shedding (Appel *et al*., 1974), and specific pathogen free cats inoculated with

homogenized tissues from a leopard that died of CDV infection showed no clinical signs except transient leukopenia (Harder *et al*., 1996). Recently, an unusual cutaneous CDV infection associated with concurrent orthopoxvirus infection has been reported in a cat (Wiener *et al*., 2013). Wild (*Felis silvestris silvestris*) and feral cats (*Felis silvestris catus*) from Portugal show evidence of low exposition to CDV (Duarte *et al*., 2012).

The age and sex of the domestic cat did not significantly affect the occurrence rate of the virus. This could be due to equal exposure of the virus to susceptible host. In dogs, Latha *et al*. (2007) and Ogbu *et al.* (2017) stated that sex of dogs does not affect the seroprevalence of CDV while Ogbu *et al.* (2023) reported that the prevalence of CDV was more in puppies than adult dog. This could be due to poor immune development in the young host compare to the adult and immunity could be affected by the constant exposure to the infective agent (Rashid *et al.,* 2009). It could also be due to the effect of maternal antibodies which interferes with the vaccinal antibodies in vaccinated animals and create window of infection in the susceptible hosts (Krakowka & Koestner 1976). Therefore, CD should be considered in cats in cases of related clinical signs especially as there are several reports of susceptibility of large Felids to CDV (Blythe *et al*., 1983; Morell, 1994; Harder *et al*., 1996; Roelke-Parker *et al*., 1996) and seropositive reports of CDV in domestic cats from Ikeda *et al.* (2011). Also, increasing numbers of cases of typical canine distemper even in vaccinated animals suggest the emergence of CDVs with different antigenic properties from the vaccine strains (Kai *et al*., 1993; Blixenkrone-Møller*et al*., 1993; Shin *et al*., 1995; Gemma *et al*., 1996; Okita *et al*., 1997) which could also affect the host's susceptibility and virulence of the virus. The genetic and antigenic diversities between CDV vaccine strains and field isolates from dogs has been reported in Japan which corroborate the probability genetic mutation of the virus (Iwatsuki *et al*., 1997).

In conclusion, this is the first report on presence of Canine distemper antigens in domestic cats in Nigeria based on available data. This research provided relevant information on canine distemper in domestic cats which may help cats owners, update researchers on possible future outbreak of the disease due to antigenic changes and sentinel role of domestic cats on the disease spread among more susceptible hosts.
It is recommended that more research on canine distemper virus should be considered especially on other species to establish the current spread of the virus and determine sentinel hosts that enable the virus survive in the environment.

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