



Research Article

Occurrence and Distribution Patterns of Canine Parvoviral Enteritis in Abuja, Nigeria

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Abstract | Canine parvoviral enteritis (CPE) is a viral disease of dogs caused by *carnivore Protoparvovirus 1* (CPV). The CPV is a small, non-enveloped, single-stranded DNA virus of the family *Parvoviridae*. CPE is a highly contagious enteric disease of dogs transmitted mainly via the fecal-oral route. This ten (10) years retrospective study was carried out to describe the pattern, prevalence and seasonality of canine parvoviral infection in Abuja based on records of laboratory confirmed CPE cases from 2011-2021 presented to Veterinary world clinic, Abuja. A total of 197 cases of gastroenteritis were recorded in the years under review, out of which 132 (67%) cases were confirmed positive for CPE using the SNAP parvovirus antigen detection kit (IDEXX Laboratories, United State). Other disease conditions include helminthiasis 25 (12.7%), canine babesiosis 3 (1.5%), while 37 (18.78%) cases were recorded as canine distemper and other bacterial enteric diseases. Monthly distribution of CPE cases in this study showed significant difference ($p < 0.05$) characterized by high prevalence in the dry season with peak of infections in the month of January. Breed disposition to CPE showed highest occurrence in Rottweiler, Alsatian and Boerboel dogs with susceptibility in male dogs (54%) than female dogs (33%) while age distribution showed high CPE affinity for younger dogs less than 12 months (86%) than older dogs (10%). In conclusion, this highlights CPV as a leading cause of canine gastroenteritis despite routine vaccinations in the study area. Further studies to evaluate field circulating CPV strains and the potency of available vaccines in Nigeria is hereby recommended.

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Introduction

Canine parvovirus (CPV) is a highly contagious virus majorly implicated in gastroenteritis cases of dogs and the known etiological agent for canine parvoviral enteritis (CPE). CPE is an enteric disease first reported in 1978, with worldwide distribution

(Carmichael, 2005). It has been reported that Alsatian, German Shepherds, Rottweilers, Pit Bull Terriers and Doberman Pinschers are more susceptible to CPE than other breed of dogs (Gombac *et al.*, 2008).

Parvoviruses are small, non-enveloped, single-stranded DNA viruses in the *parvovirinae* subfamily

of the family *parvoviridae*. There are two types of CPV: Type 1 and 2. CPV-2 is the most dominant strain that causes classical parvoviral enteritis. CPV-2 spreads directly via the fecal-oral route and indirectly through the fecal-nasal route (Carmichael, 1994). After infection, the virus replicates in the oropharyngeal and mesenteric lymph nodes as well as the thymus. Infected dogs become viremic between 1 to 5 days post infection (Tebor, 2011).

It is estimated that over one million cases of parvoviral infections occur yearly in the United States despite the availability of effective vaccines (Otto *et al.*, 2001). Puppies between the ages of 6 weeks to 6 months are mostly affected by the disease, they become vulnerable to the infection as obtained maternal antibody titer reduces. Adult dogs are less likely affected by parvoviruses due to acquired immunity post natural infections or from vaccination. Lack of protective immunity, intestinal parasitic infections, stress, overcrowding, are factors that predispose dogs to parvoviral infections (Prittie, 2004).

Clinical manifestation of parvoviral infection exist in two forms; the cardiac form and enteric form. The cardiac form is seen in young neonatal puppies less than three weeks of age and immunocompromised bitches. Affected puppy gasp, mucous membrane becomes cyanotic with death occurring within two hours of initial clinical manifestation due to non-suppurative myocarditis. Mortality may be up to seventy percent in affected litter (Otto *et al.*, 2001). Enteric form of parvoviral infection is the commonest form of the disease, CPE is the commonest cause of viral enteritis in young puppies of six weeks to six months, the infection starts as nonspecific gastrointestinal tract disturbances. Affected puppies are withdrawn and lethargic, vomiting and diarrhea occur as the disease progresses, the diarrhea becomes blood tinged, foul smelling, and intractable fluid (Streck *et al.*, 2009). Severity of the infection depends on viral inoculum, virulence and host immune response (Cohn, 1999).

Serological and molecular tests such as enzyme linked immunoassay (ELISA), polymerase chain reaction (PCR) is used to diagnose CPE (Macintire, 2006). There is no specific antiviral agent approved for treating CPV infection (Tabor, 2011) most dogs recover with appropriate supportive care directed to restoration of fluid balance (Macintire, 2006), however, vaccination is very critical in CPE management and control. In

Nigeria, commercial DHLPP vaccine is used for canine immunization against parvovirus, canine distemper, hepatitis, parainfluenza and leptospirosis beginning at 6-8 weeks of age, followed by two boosters at 3-week intervals, and lastly with an annual booster. Previous CPE reports have been documented in some other part of the country (Chollom *et al.*, 2013; Shima *et al.*, 2015; Apaa *et al.*, 2016; Gberindyer *et al.*, 2017; Francis *et al.*, 2019) but there is paucity of published data on its occurrence in Abuja, Federal Capital Territory, Nigeria. Therefore, this retrospective study is aimed at assessing the prevalence and distribution patterns of canine parvoviral enteritis in Abuja.

Materials and Methods

Study area

Abuja is the capital of Nigeria, located in the center of the country within the Federal Capital Territory (FCT) (Figure 1). Abuja municipal area council is one of the six area councils of the FCT. It replaced Lagos State, as the capital of Nigeria on 12 December 1991. At the 2006 census, the city of Abuja had a population of 776,298 making it one of the ten most populous cities in Nigeria and fast developing in Africa. Abuja's geography is defined by Aso Rock, a 400-meter (1,300 ft) monolith left by water erosion, the Presidential Complex, National Assembly and Supreme Court. It is bordered by the states of the Niger to the west and north, Kaduna to the northeast, Nasarawa to the east and south, and Kogi to the southwest. It lies between latitude 8°25 and 9°20 north of the equator and longitude 6°45 and 7°39 east of Greenwich Meridian (Mylne *et al.*, 2015).

Study design

This retrospective study of confirmed CPE positive cases was carried out in October 2021, at Veterinary world Abuja, Nigeria based on clinic case records of dogs presented with gastroenteritis from 2011- 2021 that were ultimately analyzed using SNAP parvovirus antigen detection kits (IDEXX Laboratories, United State). The clinic is one of the biggest and is the most equipped veterinary clinic in the city, engage in rendering clinical services and training of veterinary students. It is a referral center for most veterinary clinics in the Federal Capital Territory, Nigeria. The Case file records were collated and analyzed noting the breed, sex and age of affected dogs. Diagnosis of gastroenteritis was made based on clinical signs and clinical examinations, bacterial culture, hematological

examination, serum biochemistry, and the use of various rapid test kits. CPE cases were confirmed using the IDEXX SNAP Parvovirus antigen detection kit.

age (86%) than older dogs (10%) (Figure 6). Breed prevalence showed highest occurrence of CPE in Rottweiler (24%), Lhasa Apso (22%), Alsatian (20%) and Caucasian (18%). While occurrence of the disease was low in Doberman, Golden retriever, Terrier, Labrador, Pitbull and Neapolitan mastiff (Figure 7). History taking records further revealed that 75% of affected dogs had been vaccinated against parvovirus as indicated mostly in the pet green books presented by the clients using multivalent vaccines (Distemper, Hepatitis, Leptospirosis, Parvovirus and Parainfluenza vaccines– DHLPP) in accordance with standard protocol, while 10% had unknown vaccination history.

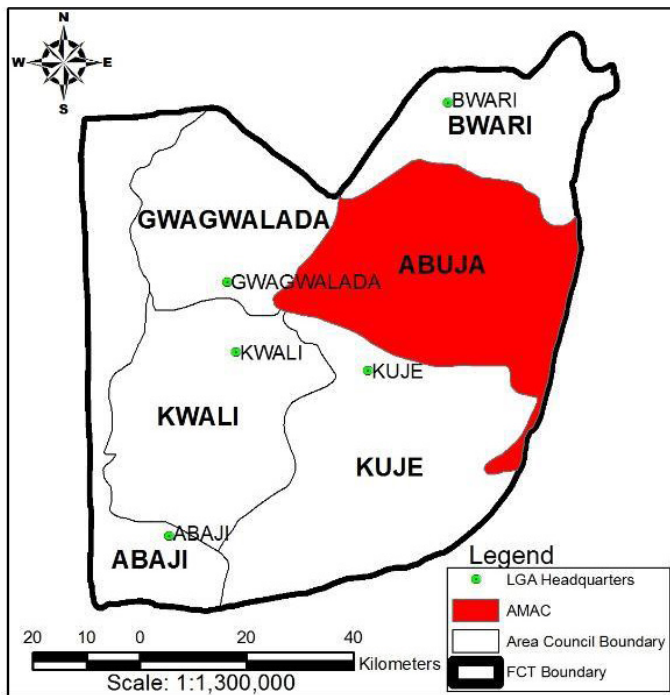


Figure 1: Map of FCT showing Abuja.

Statistical analysis

Data obtained in this study were analyzed using Statistical packages for social science (SPSS) software (version 26.0 for windows Xp and vista). Simple descriptive statistics such as percentages and charts were used to express the prevalence and distribution of CPE in dogs in Abuja.

Results and Discussion

A total number of 197 cases of gastroenteritis were recorded within the period under review. Of these, 132 (67%) cases were confirmed positive for CPE, 25 (12.7%) were cases of helminthiasis, 3 (1.5%) were cases of canine babesiosis, while 37 (18.78) cases were recorded as canine distemper and other bacterial enteric diseases (Figure 2). Seasonal occurrence of Canine Parvoviral Enteritis (CPE) was observed all year round but with high prevalence in the dry season (December to March) and peaked in January (Figure 3). Annual distribution of CPE cases analyzed showed that highest prevalence was observed in 2020 as shown in Figure 4. The number of cases analyzed showed that male dogs were more susceptible (54%) to CPE than female dogs (33%) (Figure 5). Also, the age distribution of dogs presented with CPE shows a higher occurrence in dogs less than 12 months of

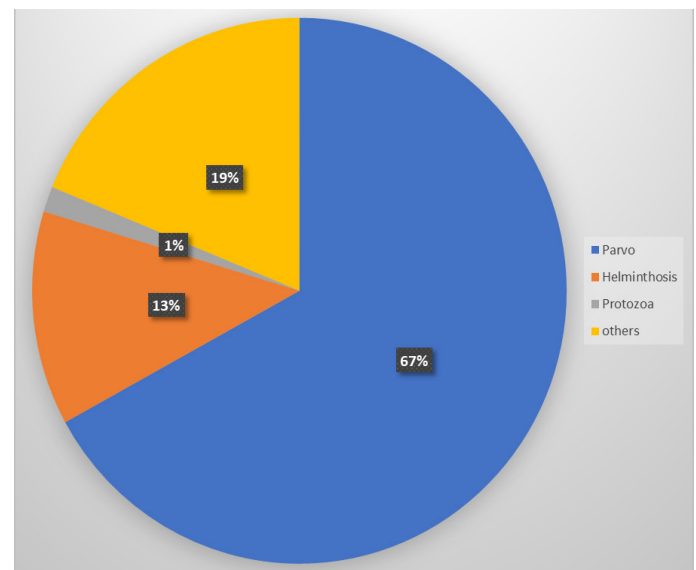


Figure 2: Distribution of gastroenteritis causing agents in Abuja, FCT -Nigeria.

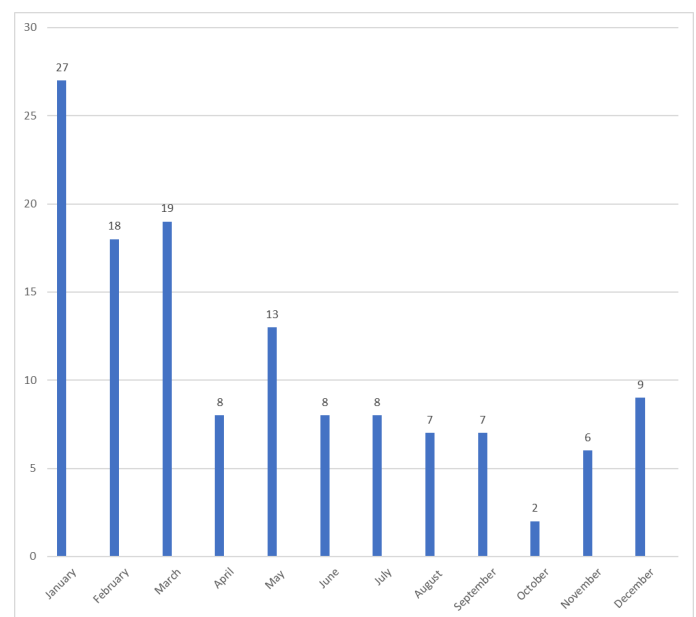


Figure 3: Monthly distribution of Canine Parvoviral Enteritis in Abuja.

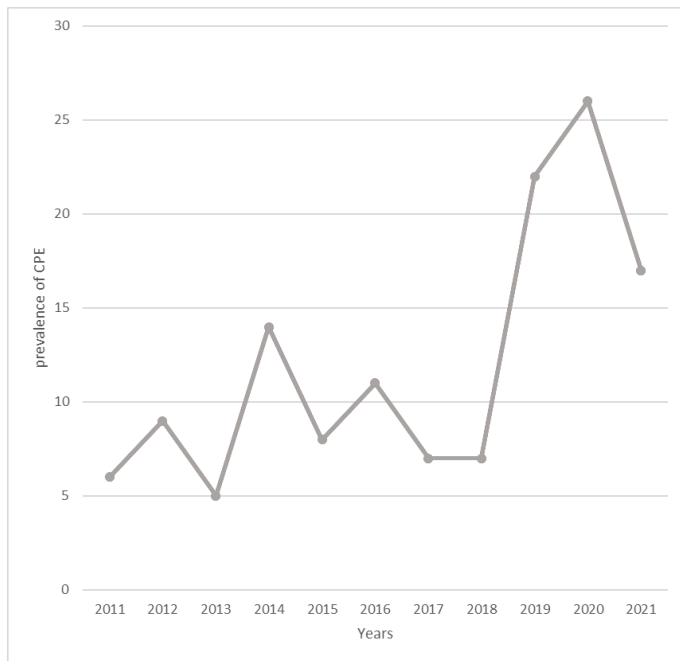


Figure 4: Annual distribution of Canine Parvoviral Enteritis in Abuja.

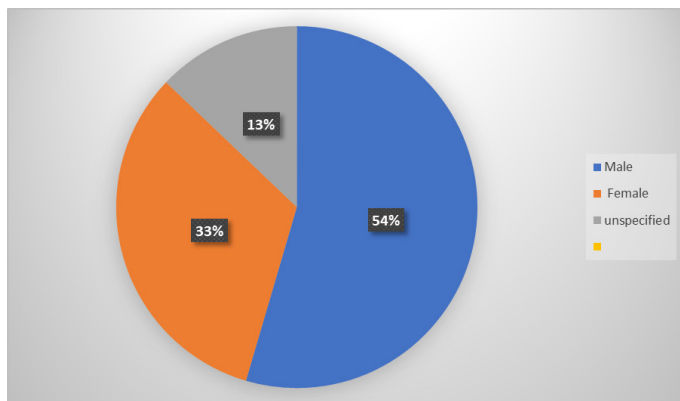


Figure 5: Distribution of Canine Parvoviral Enteritis by sex in Abuja.

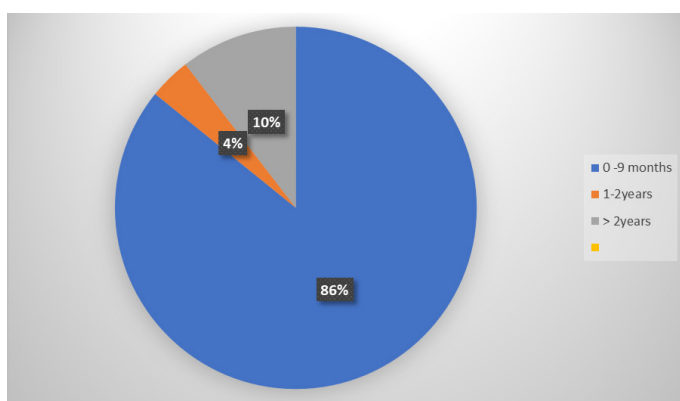


Figure 6: Age distribution of Canine Parvoviral Enteritis in Abuja.

This retrospective study reveals that Canine Parvoviral Enteritis is a leading cause of gastroenteritis in dogs in Nigeria. The high prevalence of 67% recorded in this study is in line with the findings of [Greene](#)

[and Decaro \(2012\)](#) which identified that CPE is one of the most common infectious diseases of dogs incriminated in cases of gastroenteritis and is the most prevalent virus in dogs with cases of diarrhea. This study also highlighted other causes of gastroenteritis in dogs such as helminthiasis with a prevalence of 27.7%, canine babesiosis accounting for 1.5%, while 18.78% cases were recorded as canine distemper and other bacterial enteric diseases. These infections may also co-exist with CPV, thereby increasing the severity and mortality rate of the gastroenteritis especially in puppies as previously reported by [Greene and Decaro \(2012\)](#).

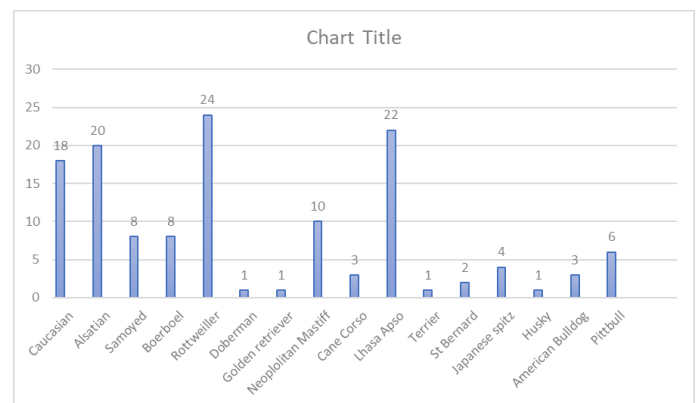


Figure 7: Breed distribution of Canine Parvoviral Enteritis in Abuja.

Monthly distribution of CPE cases in this study reveals significant difference ($p < 0.05$) across the months of the year, with high prevalence in the dry season and the peak of infections in the month of January and lower during the rainy season. The number of CPE cases increased from December to reach the peak in January and remained high in February and March. This finding is in accordance with the report of [Francis et al. \(2019\)](#), which documented high prevalence of CPE in dry season in Nigeria, similar pattern of the infection was also reported by [Shima et al. \(2015\)](#). This could be attributed to possible co infections which are predominant during the dry, dusty harmattan season in Sub-Saharan Africa.

In this study, male dogs were more susceptible to CPV (54%) than female dogs (33%) even though 13% were unspecified as shown in [Figure 4](#). This finding agrees with the report of [Shima et al. \(2015\)](#) which reported higher prevalence of CPE in male dogs (57.8%) than female (42.2%). However, [Castro et al. \(2007\)](#), in their own study, found no significant difference in exposure to CPV in both sexes and inferred that exposure to CPV is not influenced by sex.

This study has shown that most of the infected dogs (86%) were less than 12 months, while 10% of the cases were recorded in older dogs and 4% were unspecified due to incomplete record. [Prittie \(2004\)](#) reported that acute CPV-2 enteritis could be seen in dogs of any breed, age, or sex, but puppies between six weeks and six months of age appear to be more susceptible to CPE. Similarly, [Shima et al. \(2015\)](#) found that puppies less than 5 months had higher prevalence (60.3%) of CPV infection than dogs above 12 months (27%). Studies by [Castro et al. \(2007\)](#) and [Cubel et al. \(2014\)](#) showed that puppies of 2-4 months are at higher risk than older dogs. This may be due to lack of maternal derived antibodies in puppies from unvaccinated dam ([Pollock and Carmichael, 1982](#)).

Breed prevalence showed highest occurrence in Rottweiler, Lhasa Apso, Alsatian, and Caucasian and low in Terrier, Labrador, Samoyed, Boerboel, Bull mastiff and Pitbull and least in Neapolitan Mastiff, Golden Retriever, Cane Corso, Doberman, and Husky. This finding is in line with the report of [Gombac et al. \(2008\)](#) that found Alsatian and Rottweiler breeds of dogs to be at higher risk of contracting canine parvovirus infection. [Greene and Decaro \(2012\)](#) also reported that Rottweiler, Doberman Pinschers, Labrador retrievers, American Staffordshire terriers, German shepherds and Alaskan sled dogs have high risk of CPV infection.

Survival rate of infected dogs varies from 68-95 % ([Prittie, 2004](#)). Most affected dogs (70-75%) in this study survived the parvovirus infection following treatment protocol of CPE in the study center, is in line with best practice of CPE treatment which is centered on replenishing lost fluid and the maintenance of electrolyte balance as well as the prevention of secondary bacterial infection as previously documented by [Greene and Decaro \(2012\)](#). This study documented the occurrence of CPE in vaccinated dogs, affected dogs were vaccinated at least once before coming down with the disease. This finding may be attributed to failure of the vaccine to confer immunity to the affected dogs. Vaccine failure documented in this study may occur due to several factors such as lack of maintenance of cold chain and poor storage of vaccine as a result of erratic power supply, irregular or incomplete vaccination program as well as the low potency of the vaccine. This agrees with the report of [Tizzard and Yawei \(1998\)](#) and [Schultz \(2000\)](#) that vaccine failure result from interference of

vaccine immune response by maternal antibody and improper handling of vaccines.

Vaccination against CPE is the standard practice of this study center (Clinic) using a polyvalent vaccine (DHLPP) which contains modified live canine distemper virus, modified live infectious canine hepatitis virus, modified live parvovirus, modified live parainfluenza type 2 virus, inactivated culture of *Leptospira canicola* and *L. icterohaemorrhagiae*, administered at six weeks of age and two booster doses given at three weeks intervals for adequate immune response. This practice agrees with the recommendation of ([Shima et al., 2015](#)) that showed administration of DHLPP vaccine is protective for dogs and reduce morbidity and mortality due to CPE.

Conclusions and Recommendations

In conclusion, this study provides a preliminary report on the occurrence of canine parvoviral enteritis in Abuja suggesting parvovirus infections as a leading cause of canine gastroenteritis in Abuja and by implication Nigeria. Therefore, prompt vaccination of puppies starting at 4 weeks of age, strict hygienic practices and routine CPV antibody sero-monitoring are recommended. Also, further studies should be carried out to ascertain the cause of vaccine failure and the potency of available vaccines in Nigeria.

Acknowledgment

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Novelty Statement

This study reported highest occurrence of CPE during the Covid-19 pandemic in the study area despite routine vaccination using DHLPP polyvalent vaccine which may suggest the possibility of concurrent infection of SARS- COV-2 viruses in dogs.

Author's Contribution

ICA contributed to the collation of data and drafting of the manuscript. MEO contributed to the general design and writing of the manuscript. OHO and JAA revised the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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