



# The Epidemiology of Canine Parvovirus Enteritis in Dogs of Makurdi, Benue State, Nigeria

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## ABSTRACT

Since its emergence, canine parvovirus enteritis has remained the most significant and important cause of enteritis in puppies between six weeks and six months of age. The aim of this study was to carry out a retrospective study in order to assess the effect of certain factors on the prevalence of the disease in diagnosed cases presented to the veterinary teaching hospital Annex, university of agriculture Makurdi from 2010 to 2016. The overall prevalence of the diagnosed cases of canine parvoviral enteritis has been at 5.7% for the past seven years. Age, sex, breed, vaccination status was showed to have been associated with the infection. Puppies of up to five months of age, males, breeds such as the Nigerian local breed, Alsatian, Caucasian, Rottweiler and Russian shepherd dogs and unvaccinated dogs are prone to this disease. Furthermore, this study revealed that early presentation and an aggressive support management of these cases had brought about a high recovery outcome of 85.4%. The distribution of the disease according to the season showed the highest incidence of cases occurred in 2012 (25.8%) and had descended down to (9%) by 2016 with most cases witnessed around January (22.5%) in dry season and June (15.7%) in wet season. The need for educating both veterinarians and dog owners about core vaccinations in dogs is paramount.

**Key words:** Canine parvoviral enteritis, Dogs, Makurdi, Prevalence

## INTRODUCTION

The use of dogs as companion to humans cannot be overemphasized. Dogs are used as trackers, instrument of war, and healers of both the physical and emotional problems of humans (Carmichael, 2003). The population of dogs in Nigeria is estimated to be around 4.5million (Bourn et al., 1994) and infectious diseases such as parvovirus could reduce their population. The affection humans develop towards pets continues to deepen in this twenty-first century (Daodu et al., 2017).

Canine parvovirus type 2 (CPV-2) is a highly contagious and often fatal viral disease that infects the gastrointestinal tract of dogs (Touihri et al., 2009). CPV is a small, non-enveloped with spherical capsid, consisting of three proteins and a linear, single-strand DNA virus of the family Parvoviridae (Maclachlan and Dubovi, 2010). CPV-2 infection does not have predilection for sex, age or breeds of dogs (Castro et al., 2007; Gombac et al., 2008). CPV-2 affects dogs between the ages of six weeks and six months. It seldom affects older dogs, because of their natural immunity (McCaw and Hoskins, 2006; Prittie, 2004). But some breeds such as Rottweiler, Doberman pinscher, American Pit-bull terrier, Labrador retriever and German shepherd dog are at an increased risk of infection (Smith-Carr et al., 1997; Houston et al., 1996).

Certain factors that predispose puppies to CPV-2 infection are lack of protective immunity, intestinal parasites and overcrowding, poor sanitary, and stressful environmental conditions (Smith-Carr et al., 1997; Hoskins, 1997). CPV-2 can be transmitted from infected to susceptible dogs mainly through direct transmission (faecal-oral route), or indirect transmission where dogs can also become infected through exposure to fomites such as shoes, clothing, the hands of humans, food bowls and other utensils (Carmichael, 1994; Smith-Carr et al., 1997; Hoskins, 1997; Decaro et al., 2005b; Nivy et al., 2011). CPV-2 can also be transmitted via house flies, flesh flies and blow/bottle flies (Bagshaw et al., 2014).

CPV-2 has mutated twice in the early 1970s to mid 1980s given rise to two antigenic variants namely; CPV-2a and CPV-2b (Parker et al., 2001). In 2000, a third antigenic mutant named CPV-2c emerged from Italy (Buonavoglia et al., 2001). All the three antigenic variants have been distributed in different parts of the world (Bingga et al., 2014; Touihri et al., 2009; Wilson et al., 2014).

The emergence of CPV-2 infection in Nigeria can be traced back to the mid 1980s (Ezeokoli et al., 1985). Chollom et al. (2013) discovered CPV-2 with the use of conventional polymerase chain reaction (PCR). Case reports, seroprevalence, treatment regimen, immunity following CPV vaccination and risk factors affecting the disease in Nigeria have been reported (Eghafona et al., 2007; Ezeibe Maduiké et al., 2010; Nwoha, 2011; Shima et al., 2015). CPV-2a strain has been reported in Nigeria (Dogonyaro et al., 2013; Apaa et al., 2016). The virus is often shed in the faeces of infected dogs within 4-5 days of exposure before clinical signs develop and then throughout the period of illness, and for 10 days after clinical recovery (Cynthia and Scott, 2010).

CPV-2 infection manifests as an acute haemorrhagic enteritis and myocarditis. Dogs with enteritis show depression, loss of appetite, lethargy, vomiting, high fever and severe mucoid or bloody and foul smelly diarrhea (Lamm and Rezabek, 2008; Prittie, 2004). Presently, myocarditis though seen can develop in puppies less than eight weeks old dog born to unvaccinated bitches (Hoskins, 1997).

Definitive diagnosis is done by the detection of CPV-2 in the faeces of affected dogs, serology, and necropsy and histopathology (Pollock and Carmichael, 1988). Other methods of detection include electron microscopy, viral isolation, fecal hemagglutination, latex agglutination, counter-immunoelectrophoresis, immunochromatography, PCR (Macintire and Smith-Carr, 1997; Pollock and Carmichael, 1988; Desario et al., 2005; JinSik et al., 2006) which is more sensitive and reliable than traditional techniques (Desario et al., 2005).

CPV infection can be managed by aggressive symptomatic and supportive therapy (Prittie, 2004; Brown and Otto, 2008) involving fluid therapy, antibiotic, antiemetic, nutritional support, antiviral treatments and pain management (Mylonakis et al., 2016). Prevention is by vaccination of dogs with either attenuated or modified live vaccines (Martella et al., 2005). But maternally derived antibodies protect neonates as well (10 days) and it interferes with vaccines. Thus, causing vaccine failures (Pollock and Carmichael, 1982).

In Makurdi metropolis, there have been several reported cases of morbidity and mortality of CPV in dogs but there is paucity of information on prevalence, morbidity and mortality rates of the disease. Hence epidemiology of canine parvovirus infection was studied at Veterinary Teaching Hospital (VTH) of the University of Agriculture Makurdi (UAM).

## MATERIALS AND METHODS

### Study area

This study was conducted in Makurdi metropolis, Benue State, Nigeria. Makurdi, the capital of Benue state lies between latitude 7° 15' - 7° 45' N and longitude 8° 15' - 8° 40' E. It has a population of about 500,797 (The World Gazetteer, 2007), it lies in the Guinea savannah vegetative belt and on the bank of the river Benue which is the second largest river in Nigeria. The river divides the town into North and South banks and the town covers an area of 16 km<sup>2</sup> (Omudu and Amuta, 2007). It has a tropical climate with a temperature ranging between 21.70 - 24.70°C (minimum) and 29.70-33.70°C (maximum). The climate of Makurdi town is the tropical wet and dry type, Koppen's Aw classification, with double maxima (Ayoade, 1983). The rainy season lasts from April to October, with five months of dry season (November to March). Annual rainfall in Makurdi town is consistently high, with an average annual total of approximately 1173 mm (Abah, 2012).

### Data collection

Data of 1571 treated cases of CPVE in dogs presented at the VTH Annex, UAM from 2010 to 2016 were assessed. History, clinical signs and therapeutic regimens of CPV were reviewed. The presented signs were foul smelly haemorrhagic diarrhoea, emaciation, vomiting and lethargy. The vaccination history, treatment outcome, sex, breeds and age of dogs were recorded. The status of the vaccination history was categorized as vaccinated, unvaccinated and unknown. Similarly, the treatment outcomes of the cases following medical intervention were classified as either "recovered or dead". The suspected cases were confirmed using SensPERT<sup>®</sup> canine parvovirus antigen test kits (VetALL, Korea).

### Statistical analysis

The data collected were analysed using Microsoft Office Excel (2007) for descriptive analysis of variables such as age, sex, and vaccination history and treatment outcome.

## Ethical approval

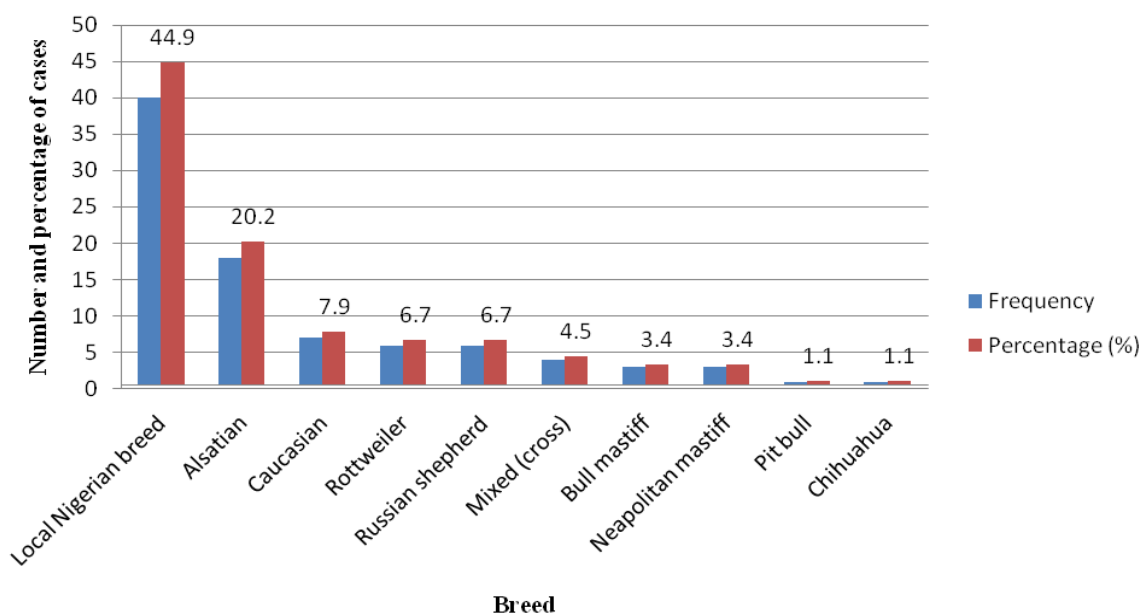
This study was certified and approved and was performed according to the ethics of committee of the college of veterinary medicine, University of Agriculture, Makurdi, Nigeria.

## RESULTS

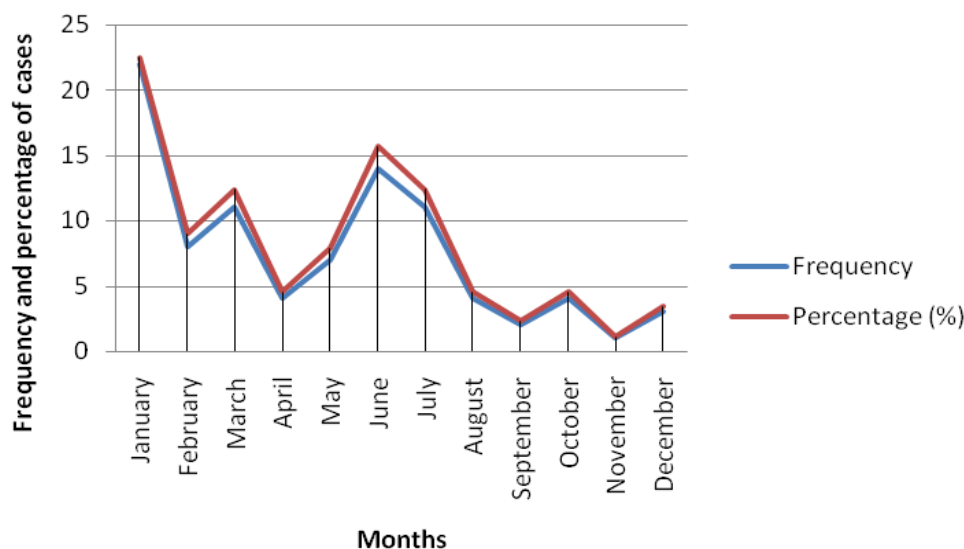
Of the 1571 dogs that were brought to the VTH Annex, UAM, Makurdi, for over a period of seven years (2010 - 2016), 89 (5.7%) were diagnosed of CPV enteritis. Table 1 shows the analysis of diagnosed CPVE cases according to age, sex, vaccination status, treatment outcome and season where as the analysis of diagnosed CPVE cases by breed of dogs, month and year have been presented in diagrams 1-3. The local Nigerian breed had the highest frequency of cases 40 (44.9%), followed by Alsatian 18 (20.2%), Caucasian 7 (7.9%), Rottweiler, Russian shepherd 6 (6.7%), Mixed 4 (4.5%), Bull mastiff, Neapolitan mastiff 3 (3.4) and Pit-bull and Chihuahua 1(1.1%) (Diagram 1). The highest incidence of cases was recorded more in the month of January 22 (22.5%), June 14 (15.7%), March and July 11 (12.4%), February 8 (9%), May 7 (7.9%), April, October 4 (4.5%), December 3 (3.4%), September 2 (2.3%) and November 1 (1.1%) respectively (diagram 2) while the peak incidence of cases were recorded in the year 2012, 23 (25.8%), 2013, 16 (18%), 2014, 15 (16.9%), 2011, 11 (12.4%), 2015, 9 (10.1%), 2016, 8 (9%) and 2010, 7 (7.9%) respectively (Diagram 3).

**Table 1.** Analysis of diagnosed canine parvoviral enteritis cases base on age, sex, vaccination status treatment outcome and season, presented to the veterinary teaching hospital, university of agriculture, Makurdi from 2010 to 2016

Groups	Number of diagnosed cases of canine parvovirus enteritis	
	Frequency	Percentage (%)
<b>Age (Months)</b>		
0-5	71	79.8
6-12	12	13.5
>1 year	6	6.7
<b>Sex</b>		
Male	54	60.7
Female	35	39.3
<b>Vaccination status</b>		
Vaccinated	25	28.1
Unvaccinated	42	47.2
Unknown	22	24.7
<b>Treatment outcome</b>		
Recovered	76	85.4
Dead	13	14.6
<b>Season</b>		
Dry (Nov- March)	43	48.3
Wet (April- October)	46	51.7

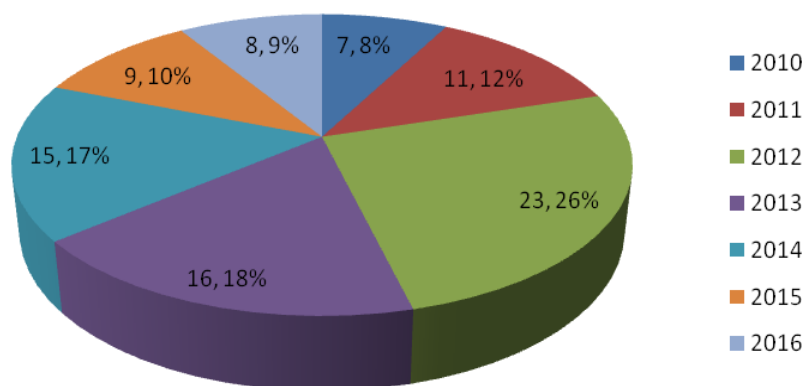


**Diagram 1.** The distribution of diagnosed canine parvoviral enteritis cases base on breed in university of agriculture Makurdi, Nigeria during 2010-2016.



**Diagram 2.** The distribution of diagnosed canine parvoviral enteritis cases base on months in university of agriculture Makurdi, Nigeria during 2010-2016.

**Frequency and percentage of cases of canine parvovirus enteritis**



**Diagram 3.** The distribution of diagnosed canine parvoviral enteritis cases in Nigeria by years at the veterinary teaching hospital (2010-2016).

## DISCUSSION

The study has shown that CPVE has been endemic in Makurdi metropolis for years with a 5.7 % prevalence rate (89/1571). Although, the prevalence rate in this study appears to be much lower compared to the values reported in Ilorin 6.4% (105/1645) (Daodu and Ajiboye, 2018), Effurun/Warri 13.4% (204/1527) (Shima et al., 2015), Jos North/South 17.4% (12/70) (Ogbu et al., 2016), Tunisia 32.1 % (54/168) (Tagorti, 2018), Nigeria and south Africa 96.7% (30/31), 98.2% (106/108) (Dogonyaro et al., 2013) and Zimbabwe 84.9% (191/225) (Mcree et al., 2014) but it was higher than the report from Vom 2.8% (87/3075) (Mohammed et al., 2005). The low prevalence may be due to low patronage of the VTH by dog owners, poor record keeping of medical cases and/or lack of proper diagnostic techniques/equipment then. Therefore, this report is a well representation of the cases of CPVE in Makurdi since the VTH is the major veterinary hospital where cases are handled in Makurdi metropolis.

The fact that the group (0-5 months) had a higher incidence rate of 79.8% (71/89), 6-12 months, 13.5% (12/89) and > 12 months, 6.7% (6/89) agrees with the reports from Effurun/Warri 60.3% (0-5 month), 27% (6-11 months) and 12.7% (12 months and above) (Shima et al., 2015), Argentina 86% (1-5 months) and 14% (6 months and above) (Calderon et al., 2011), United States of America 59% (less than 6 months) and 41% (more than 6 months) (Glickman et al., 1985), Slovenia 67.6% (1-5 months), 25.7% (6-12 months) and 6.8% (more than 12 months) (Gombac et al., 2008), India with 40.75% for (0-6 months), 24.19% for (7-12 months) and 10% for (12 months and above) (Basava, 2012). It has already

been reported that CPVE primarily affects puppies that are between the age of 6 weeks to 6 months (Marcovich et al., 2012; Mccaw and Hoskins, 2006; Prittie, 2004).

Local Nigerian breeds 44.9%, Alsations 20.2%, Caucasians 7.9%, Russian shepherd and Rottweiler 6.7%, mixed breed 4.5%, Neapolitan mastiff and Bull mastiff 3.4% each and the least Pit-bull and Chihuahua 1.1% each. The reasons for breeds of dog being susceptible to this dreaded disease remain unknown. Although, there have been earlier reports that Doberman Pinscher, Rottweiler and German Shepherd puppies are under greater risk of developing CPV enteritis than other breeds (Glickman et al., 1985; Houston et al., 1996; Castro et al., 2007; Shima et al., 2015). Our findings disagree with the report that Alsations, Rottweilers and Doberman pinschers appears to be more at risk (Gombac et al., 2008; Castro et al., 2007). Basava (2012) reported that, the Spitz breed had the highest prevalence (43.75%), followed by Doberman (42.85%), Pomeranian (37.5%), Alsatian (31.03%), Mongrel (28.71%) and Pug, Mastiff, Golden retriever, Labrador (27.77%). Dogs with highest incidence of cases of CPVE were the males (60.7%) as against females with (39.3%). This result agrees with the reported values in males (83.33%) and females (16.7%) respectively (Castro et. al., 2007; Basava, 2012) but disagrees with the finding of Umar et al. (2015) who reported that female (58.5%) were more at risk than the males (41.5%). In Nigeria, male dogs are preferred to females by owners as security with exception of the few that breed them.

The prognosis of CPVE is as low as 9.1% in the absence of treatment, and 64% or higher with treatment (Otto et. al., 1997). In the present study, the prognosis after treatment is 85.4%. This finding corroborates with the reports of Prittie (2004) and Macintire and Smith-Carr (1997) indicating that CPVE could be treated symptomatically. But unvaccinated dogs (47.2%) had the highest prevalence, followed by vaccinated dogs (28.1%) and dogs with unknown vaccination status (24.7%). This also agrees with the result of Basava (2012) who reported (35.4%) for unvaccinated and vaccinated dogs (16%) respectively. The lower prevalence rate of CPVE in vaccinated dogs indicated that current vaccine offer protection (Cavalli et al., 2001).

Monthly prevalence of CPVE in January (22.5%), June (15.7%), March and July (12.4%), February (9%), May (7.9%), April and October (4.5%), December (3.4%), September (2.3%) and November (1.1%) show that cases are seen in the dry season (48.36) and more in the wet season (51.7%), respectively. Shima et al. (2015) reported highest prevalence in January (17.2%) and lowest in April (2.0%). In contrast, Basava (2012) reported highest prevalence in July (48.97%) and the lowest in March (20%) and Houston et al. (1996) also reported that dogs are most likely to be admitted between July to September in Canada. Meanwhile, in the last seven years, the disease had its highest prevalence in 2012 (25.8%) followed by 2013 (18%), 2014 (16.1%), 2011 (12.4%), 2015 (10.1%), 2016 (8%) and 2010 (7.9%) respectively. This was due to lack of awareness on the preventive measures of the disease and poor regimen management.

## CONCLUSION

CPVE is endemic in Makurdi metropolis and could be affected by age, sex, breed, vaccination status, treatment (management) and seasonal variations. Vaccination and therapy of the affected dogs could improve the well-being and longevity of the dogs. This result will serve as recorded information to veterinarians, dog owners and breeders in and around Makurdi in giving adequate care and taking preventive measures generally but particularly during the high prevalence period of CPVE.

## DECLARATIONS

### Author's contribution

ATM, AAA, NSA, IAF, AIW collated the data. NHC and TT analysed the data. TMT, ATT and SAS designed the work while TMT and SAS reviewed the manuscript.

### Consent to publish

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### Competing interests

The authors have declared that no competing interest exists.

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