European Journal of
Animal Health
(EJAH)

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AJP

European Journal of Animal Health
ISSN 2957-9171 (online)
Vol.3, Issue 1, pp 25 - 36, 2022

www.ajpojournals.org

Clinical and Epidemiological Aspect of Canine Gastroenteritis in Lubumbashi, DR Congo.

Syaghuswa Kasereka Bourgeois[1*], Numbi Malale Alain[2], Lenge Mushiya-Ngoi[3], Mahangaiko Muyumba Gaspard[2]

[1]Department of Pathology, Faculty of Veterinary Medicine, University of Lubumbashi, B.P. 1825, Democratic Republic of Congo

[2]Department of internal medicine, Faculty of Veterinary Medicine, University of Lubumbashi, B.P. 1825, Democratic Republic of Congo

[3]Department of Surgery, Faculty of Veterinary Medicine, University of Lubumbashi, B.P. 1825, Democratic Republic of Congo

[*]Corresponding Author's Email: bourg.2013@gmail.com

Abstract

Introduction: Gastroenteritis is a disease known for its high morbidity and mortality in dogs. It shows wide variations in causes and prevalence throughout the world. No study in Lubumbashi has mentioned it to date.

Purpose: The purpose of this cross-sectional study was to provide veterinary clinicians in Lubumbashi with data on the prevalence, seasonality associated with canine gastroenteritis and to assess the clinical diagnostic capacity of veterinary clinicians in the city of Lubumbashi.

Methodology: The retrospective 5-year clinical records of 762 dogs were consulted where only 455 clinical cases had completed records. These clinical records were collected from 14 veterinary practices and 4 veterinary clinics. A pre-populated survey form was distributed to all veterinary practices and clinics that did not complete clinical records during the study period.

Results: The prevalence of canine gastroenteritis was 47.5% [(95% CI):44.5-53.3] of ill dogs. This prevalence was influenced by vaccination status, breed, age and period of year ($p<0.05$). The sex did not show any influence ($p>0.05$). The highest prevalence was found in dogs between 0 and 6 months of age (80%). The most prevalent month was July, corresponding to the peak of the dry season in Lubumbashi. On the other hand, the least prevalent month was February, corresponding to the peak of the rainy season. Dogs in all communes were affected with the highest prevalence in the Commune of Lubumbashi 43.1% [(95% CI): 36.4-49.6] followed by the Annex commune 47 cases or 21.7% [(95% CI): 16.2-27.2]. During clinical consultations, three gastrointestinal diseases were suspected, including canine parvovirus enteritis, helminthiasis and non-specific gastroenteritis.

Unique contribution to theory and practice: This study was the first to record epidemiological data on canine gastroenteritis treated in veterinary practices and clinics in the city of Lubumbashi. It is therefore part of the objective to improve the epidemiological and clinical knowledge of canine gastrointestinal pathologies. Based on these results, the authors recommend to the dog breeders of Lubumbashi on the usefulness of vaccination and deworming of dogs especially during the dry season and to the veterinarians, rational management of the clinical records of the patients while encouraging them to practice autopsy and paraclinical examinations.

Keywords: *Gastroenteritis, canine, epidemiology, prevalence, Lubumbashi.*

1.0 Introduction

Canine gastroenteritis is an identified condition of frequent morbidity and mortality in dogs (Shima et al., 2021). It occurs in all breeds and ages of dogs (Kataria et al., 2020) and is prevalent in young dogs less than 6 months of age (Kouamo et al., 2021; Shima et al., 2021). It has several causes including viral, bacterial, parasitic infections, nutritional causes and poisoning (Rodrigues et al., 2018). This etiological plurality, associated with the simultaneous possibility of co-infections, make canine gastroenteritis a clinical emergency (Gizzi et al., 2014; Rodrigues et al., 2018). Several types of bacteria and parasites have been mentioned by the literature respectively *Salmonella spp*, *Clostriduim spp*, *Escherichia coli* (Kjaergaard et al., 2016; Priya et al., 2017), *Campulobacter jejuni*, *Cryptosporiduim spp*, *Giardia spp* , and *Toxocara canis*, *Toxoscaris leonina*, and *Isospora canis* (Byakya et al., 2018), *Dipyllidium caninum*, *Ancylostoma caninum*(Hawdon and Wise, 2021).

Six viruses, canine parvovirus-2(CPV-2), canine corona virus (CCov), canine distemper virus (CDV), canine rotavirus CRV, canine adenovirus-2 (CadV-2), and canine astrovirus(CaAstV) are considered as viral agents of canine gastroenteritis(Dema et al., 2022). These viral agents are recognized since the late 1970s, as one of the most common causes of infectious diarrhea in young dogs under 6 months old (Figueiredo et al., 2017).This viral cause accounts for more than 80% of cases of canine gastroenteritis (Rodrigues et al., 2018). Among these viruses, canine parvovirus-2(CPV-2) has been considered by the literature as the most important cause of the infectious diarrhea of the unvaccinated young dog (Nizami et al., 2020; Geetha and Selvaraju, 2021; Ukwueze et al., 2021).

Whatever the etiology of canine gastroenteritis, it leads to electrolyte imbalance that results in dehydration and early death (Sousa et al., 2021). Research reveals that canine gastrointestinal diseases are characterized by inappetence, vomiting, lethargy, mucoid to hemorrhagic diarrhea and dehydration (Agnihotri et al., 2017; Abdel-Rhman et al., 2019;) and that the factor of age, vaccination status and deworming allow to differentiate it clinically. However, confirmation of either cause relies on the use of polymerase chain reaction (RT PCR) of fecal samples (Gizzi et al., 2014), histopathology and immunohistochemistry on autopsy (or endoscopy) samples of dogs with gastroenteritis (Folitse et al., 2018).

Research on canine gastroenteritis is overabundant in many countries including African countries such as Zambia (Saasa et al., 2016), Cameroon (Kouamo et al., 2021), Nigeria (Shima et al., 2021); where the prevalence, etiological agents and influencing factors of canine gastroenteritis have been documented. However, there is a lack of such data in DR Congo in general and in Lubumbashi city in particular, where in many veterinary practices and clinics, canine gastroenteritis is mainly diagnosed based on clinical signs. No research has documented the epidemiology of canine gastroenteritis in Lubumbashi to date. These data would be useful to improve the epidemiological and clinical knowledge of canine gastrointestinal diseases in Lubumbashi.

It is in this context that the objective of this study was to provide veterinary clinicians in Lubumbashi with data on the prevalence, seasonality associated with canine gastroenteritis and to evaluate the clinical diagnostic capacity in the city of Lubumbashi.

2.0 Materials and Methods

2.1 Study Area

This survey was carried out in 14 veterinary practices (Action Vétérinaire, Nassa, Agrivet Dish, King Club, Référence Plus, Seth, Dr. Venance, Dr. Mike Mbuyi, Une Santé, de la Paix, Labrador, Lamdichem, Care and Protection of Animals and Le Bien Etre) and in 4 veterinary clinics (Cliniques Vétérinaires Publiques de Lubumbashi, Clinique d'Espoir des Animaux, Clinique de Zoo de Lubumbashi and Clinique Vétérinaire de l'Université de Lubumbashi) which are located throughout the city of Lubumbashi. Lubumbashi is in the southeast of the DRC in the province of Haut-Katanga, at an altitude of 1250 meters, at 11', 67° South and 27', 48° North. The climate is tropical humid with a dry season of more than 6 months (April to October) and a rainy season of 5 months (November to March)(Kalombo, 2015).The average annual temperature is 20°C, the average annual total rainfall is 1230 mm, with January and February as the rainiest months. The average daily relative humidity is 60% (Assani, n.d.). Lubumbashi city has about 5 million inhabitants distributed in these 7 communes (Annexes, Kamalondo, Kampemba, Katuba, Kenya, Lubumbashi and Ruashi) (Kalombo, 2015).

2.2 Animals

Animals in this study included dogs of different breeds and ages that were consulted at the veterinary practices and clinics in the city of Lubumbashi from January 2017 to August 2021. All clinical records of these veterinary practices and clinics were checked. The availability and completion of the clinical records were not identical for all, some practices and clinics did not have established clinical records, others had some well completed, others irregularly completed. A survey form was distributed to all practices and clinics that did not have a clinical records. The purpose of the survey form was to collect their practical knowledge of gastrointestinal diseases. Two epidemiological survey techniques, the individual survey technique and the group survey technique with the same form were used as described by Benet et al. (1993). The data from the forms were annexed and processed together with the data from the clinical forms. Thus, a total of 762 clinical records of dogs consulted for various complaints were collected during the study period. Among them, only 455 clinical records were well completed on the basis of the variables to be studied (origin, date of consultation, reason for consultation, age, sex, breed, clinical sign, vaccination status, diagnosis determined and treatment applied). Any case of canine gastroenteritis was thus detected based on clinical sign as described by Rodrigues et al. (2018). 216 dogs of all ages had gastroenteritis and 239 were consulted either for vaccination or for a general health check-up or for a traumatic event or other pathology.

2.3 Statistical analysis

For each clinical dog case, data on reasons for consultation, date of consultation, breed, sex, age, origin, vaccination history, observed clinical signs, diagnosis and treatment were carefully collected and recorded in the Excel spreadsheet version 2013. Descriptive and analytic analyses were carried out using R software. They were submitted to a Chi-square test and a Z-test for the comparison of two proportions at a 95% confidence level.

3.0 Results

Out of 762 clinical records of dogs from different veterinary practices and clinics in Lubumbashi city that were consulted, a total of 455 clinical records were duly completed of which 216 clinical

records were canine gastroenteritis with a prevalence of 47.5% [(95% CI):44.5-53.3] in this study from January 2017 to August 2021. This prevalence was influenced by certain variables as demonstrated in table 1.

Table 1: Influence of vaccination status, season, sex and age on canine gastroenteritis in Lubumbashi

Variables		Number of canine gastroenteritis N= 216		X^2	df	p-value
		Freq	Percent (%)			
Period	**Dry season**	146	67.6			
	Rainy season	70	32.4	26.74	1	0.0000002
Vaccinal status	**unvaccinated**	205	94.9			
	vaccinated	11	5.1	174.24	1	<0.0000
Sex	**Male**	115	53.2			
	Femelle	101	46,8	0.907	1	0.34
Age	**≤ 6months**	173	80			
	> 6 months	43	20	78.24	1	<0.0000

The findings revealed that the variable unvaccinated, the variable age and the variable season had a significant influence on the occurrence of canine gastroenteritis cases in Lubumbashi ($p<0.05$), while the variable sex showed no influence. The clinical cases of canine gastroenteritis were observed monthly throughout the study period. The highest occurrence was recorded in the month of July p-value=0.000 (full dry season) 27 cases out of 216 or 12.5 % [(CI95%) : 10.5 -16.4], while the lowest occurrence was recorded during the month of February (full rainy season) 7 cases out of 216 or 3.2%[(CI95%) :1.2-4.2] as shown in figure 1.

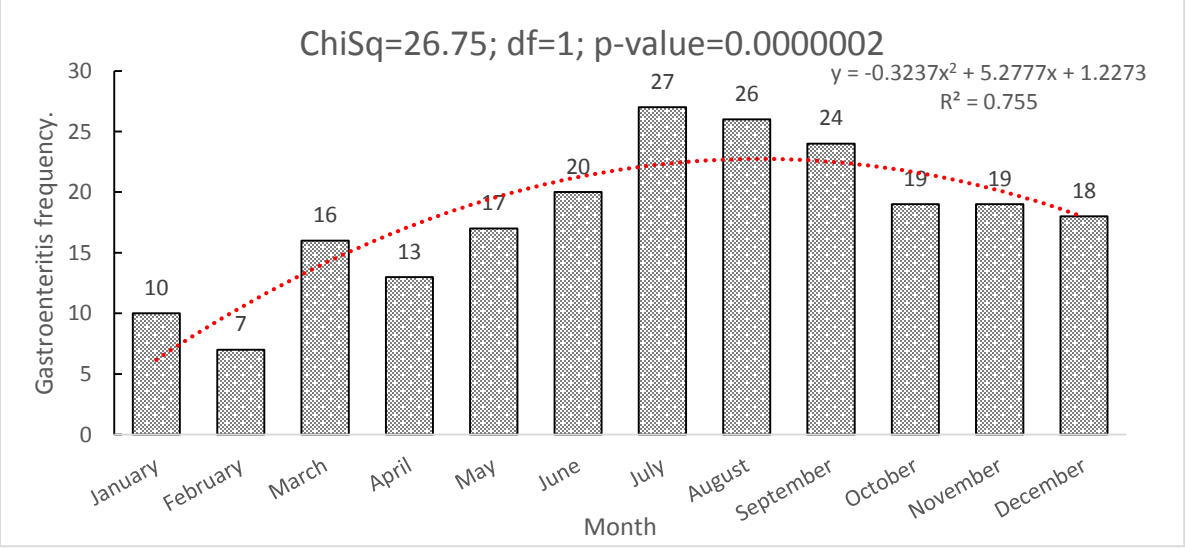

Figure 1: Monthly frequency of canine gastroenteritis during the study period.

During the study period from January 2017 to August 2021, Figure I shows that the monthly frequency curve of canine gastroenteritis starts climbing in the month of June 20 cases or 9.2%[(CI95%:5.2-11.2] with the peak in the month of July 27 cases or 12.5%[(CI95%): 10.5 - 16.4], followed by the month of August 26 cases or 12% [(CI95%) : 10-15.9) and September 24 cases or 11.1%[(CI95%): 9.1-15]; stabilizes in October 19 cases or 8.7%[(CI95%:4.7-10.7], November 19 cases or 8.7%[(CI95%: 4.7-10.7], and December 18 cases or 8, 3%[(IC95%): 4.3-10.3] to drop too low in January 10 cases or 4.6%[(95%):2.6-5.6] and February 7 cases or 3.2% [(IC95%:1.2-4.2]. The dogs of all the communes of Lubumbashi city were affected by canine gastroenteritis. The highest frequency was recorded in the commune of Lubumbashi 93 cases or 43.1% [(95% CI): 36.4-49.6] followed by the Annexe commune 47 cases or 21.7% [(95% CI): 16.2-27.2] (figure 2)

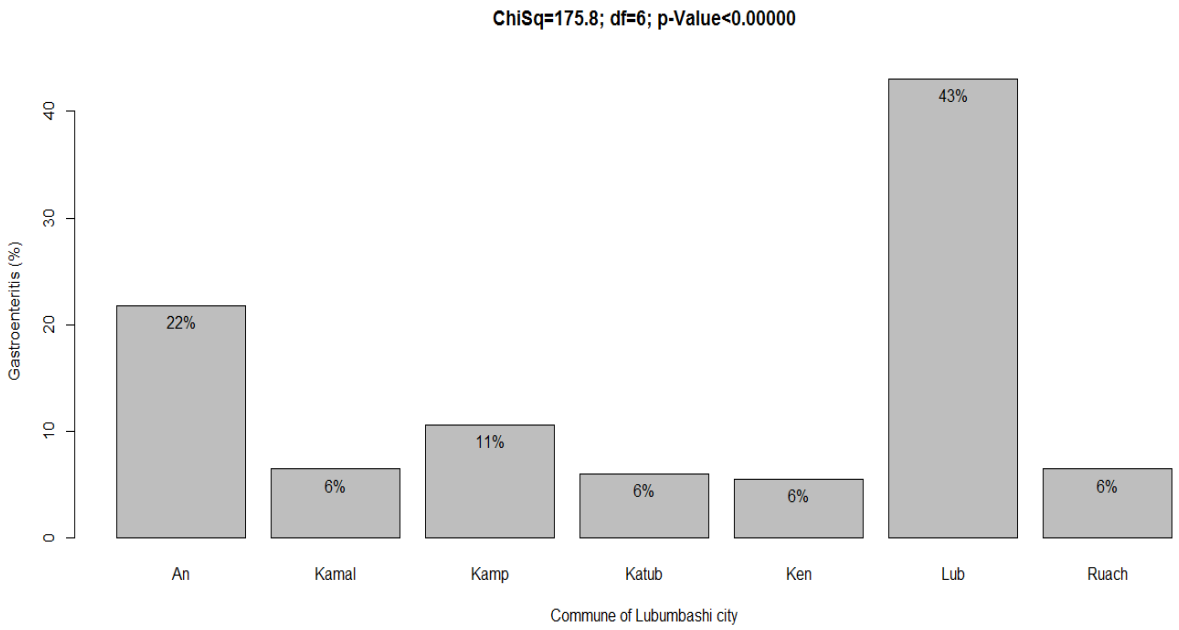

Figure 2: Frequency of distribution of clinical cases of canine gastroenteritis in Lubumbashi city.

Figure 3 revealed that several local and imported breeds were affected, with the crossbred breed being the most representative with a frequency of 120 out of 216 or 55.5% [95% CI: 48.9-62.2], followed by the imported breeds Boerlboel and German Shepherd with a frequency of 9.7% [(95% CI): 5.7-13.6] and 9.2% [(95% CI): 5.3-13.1] respectively.

European Journal of Animal Health
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www.ajpojournals.org

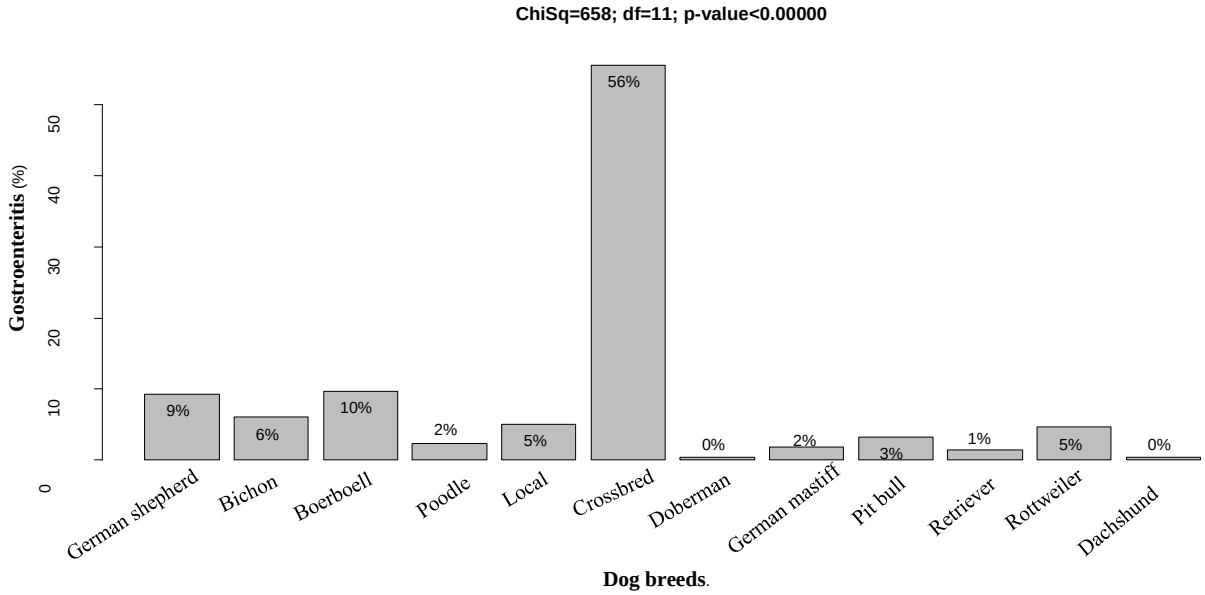

Figure 3: Frequency of clinical cases of canine gastroenteritis according to breed.

Veterinary clinicians in Lubumbashi are more confronted with viral gastroenteritis, especially canine parvovirus enteritis, followed by non-specific gastroenteritis and helminthiasis (table II).

Table 2: Classification of cases of gastrointestinal diseases according to age, based on the analysis of data from clinical records of veterinary practices and clinics in the city of Lubumbashi.

Age group	Canine parvovirus enteritis	Helminthiasis	Nonspecific-gastroenteritis	Total
≤6 month	100(46.2)	26(12.0)	47(21.7)	173(80)
>6 month	11(5.1)	22(10.1)	10(4.6)	43(20)
Total	**111(51.3)**	**48(22.1)**	**57(26.3)**	**216(100)**

The frequency observed for the three types of gastrointestinal diseases was significantly different by age ($p<0.05$). Animals less than 6 months of age were more affected.

European Journal of Animal Health
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www.ajpojournals.org

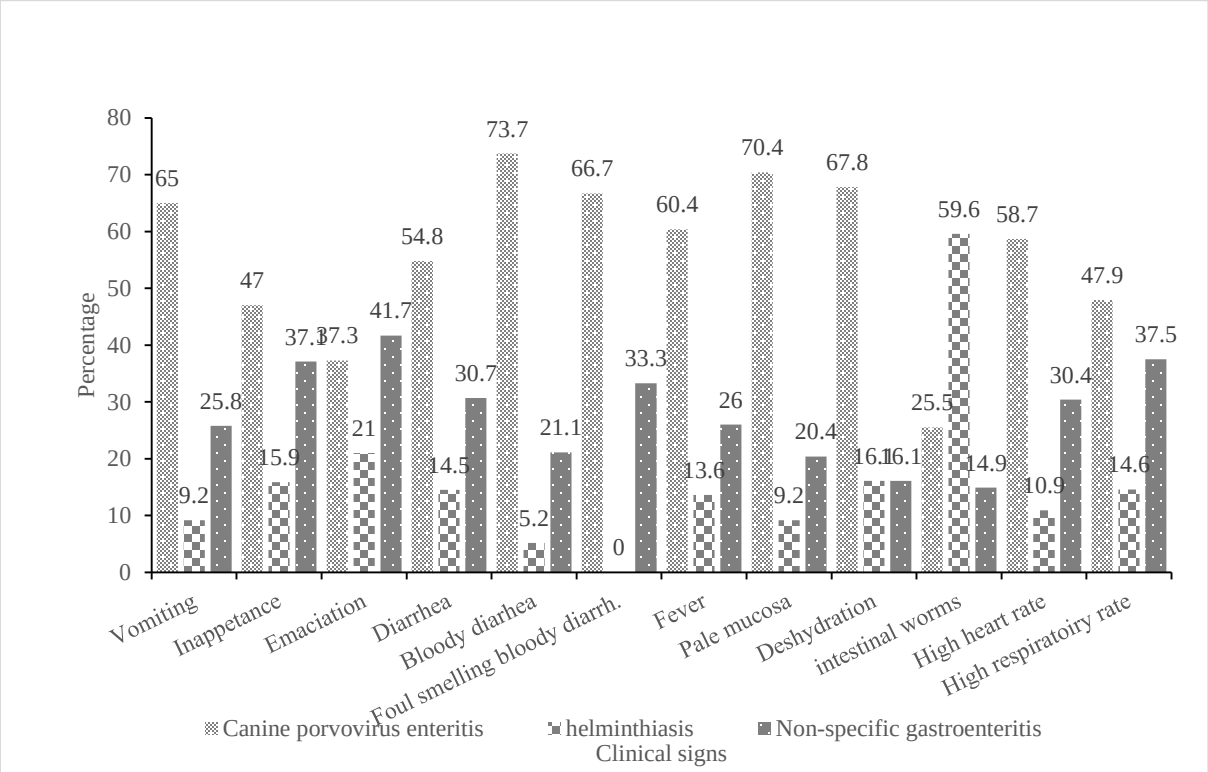

Figure 4: Clinical signs observed in cases of gastrointestinal diseases according to data from clinical records of veterinary practices and clinics in the city of Lubumbashi.

This figure shows 13 types of clinical signs with varying frequencies according to the gastrointestinal diseases observed by the veterinary practices and clinics in Lubumbashi.

4.0 Discussion

A total of 455 clinical cases of dogs were included in this study from January 2017 to August 2021. The prevalence of canine gastroenteritis during this period was found to be 47.5% [(95% CI):44.5-53.3] or 216 cases out of 455 dogs. This prevalence was significantly influenced ($p<0.05$) by dog breed, period of the year, vaccination status, and age. These results corroborate those reported in Nigeria by Shima et al (2021), who also observed a significant influence ($P<0.05$) of breed, period of the year, vaccination status and age on canine gastroenteritis. However, they registered a 41.2% lower prevalence compared to this study.

In this research, the breeds of dogs studied were found to be significantly sensitive ($p<0.05$) to canine gastroenteritis, with the crossbred breed being the most representative with 55.5% [IC95%: 48.9-62] followed by the Boerboel breed 9.7% [(IC 95%): 5.7-13.6] and the German Shepherd breed 9.2% [(IC95%): 5.3-13.1]. These results are in contradiction with those performed in Solvania on parvovirus gastroenteritis where no significant sensitivity ($p<0.05$) between dog breeds was observed in regards to mortality rates due to parvovirus gastroenteritis (Gombač et al., 2008). In contrast, our results corroborate those of Rakha et al.(2015) and Kouamo et al.(2021) who found a highly significant sensitivity $p<0.001$ of dog breed to digestive problems. For Rakha et al. (2015), it was the German Shepherd breed that was the most sensitive compared to the other breeds, while for Kouamo et al., (2021) it was the crossbred breed. However, these researchers,

Rakha et al. (2015) and Kouamo et al. (2021) in their study recorded high prevalence respectively of 56.50% and 58% comparable to that reported in this study. Similar research on canine gastroenteritis has noted lower prevalences than that found in this study 13.40% (Tagorti, 2019) and 12.24% (Kataria et al., 2020). They also confirmed the high rate of canine gastroenteritis cases in the crossbreed 32.38% and German shepherd (19.05%), followed by Labrador (10.79%).

The distribution of canine gastroenteritis significantly associated($p<0.05$) with the crossbreed would be related to its numerical predominance in the city of Lubumbashi and its easy cost of acquisition, the imported breeds being very expensive (Kouamo et al., 2021). Thus, the vagrancy and lack of care and attention that this crossbred breed receives locally, exposes it to pathogens (Sousa et al., 2021; Tagorti, 2019).

This variability in the prevalence of canine gastroenteritis and its significant frequency in the different breeds studied compared to those observed elsewhere could be associated with the agro-ecological effects of the geographical zones of study and the different management and habits of the dogs; where locally, this study demonstrated a significantly ($p<0.05$) high rate of unvaccinated dogs (Table 1). This significantly high rate of unvaccinated dogs demonstrates that these animals were not protected against microbes. This could be due, on the one hand, to the ignorance of some owners neglecting the welfare of their animals, on the other hand, to the relatively high cost of vaccination and bad breeding practices (Shima et al., 2015). As for the cases that were vaccinated but developed pathology, they would be associated with vaccination failure that would have resulted from interference with maternally derived antibodies, a common cause of vaccine failure in puppies (Shima et al., 2015; Chastant-Maillard et al., 2018), especially since most of the animals in this study (table 1) were very young.

In this study, canine gastroenteritis showed a seasonal variation with the highest occurrence recorded in July corresponding to the full dry season and the lowest in February corresponding to the full rainy season. This result is in contradiction with the research of Rakha et al. (2015) in Egypt while corroborating those of Shima et al. (2021) in Nigeria. However, for Shima et al. (2021), the high prevalence of canine gastroenteritis was registered during January corresponding to the peak of the dry season in Nigeria while the low prevalence was registered during August and September corresponding to the peak of rainfall. The difference in the temporal and seasonal distribution of canine gastroenteritis frequency between this study and that of other researchers is thought to be associated with differences in climate between geographical settings (Tagorti, 2019). Similarly, the occurrence of potential infectious agents responsible for diarrhea and vomiting may be influenced by climatic conditions; with the dry season appearing to be more stressful for animals on the one hand, and increasing the frequency and duration of walks, dog-to-dog interactions, and the frequency of foraging hence their exposure (Sævik et al., 2012).

In agreement with other research (Bhat et al., 2015; Kataria et al., 2020), young age in this study was significantly associated ($p<0.05$) with canine gastroenteritis where 80% of the dogs were less than 6 months old. This would be related to the vulnerability of dogs in Lubumbashi where 94.9% were unvaccinated. While, compared to adults, young dogs have a curiosity nature, they may in vain try to eat or feel things around them, go out and move freely in the yard, from where they may ingest garbage and contract harmful pathogens (Bhat et al., 2015). In this study, sex demonstrated no significance $p>0.05$ in relation to canine gastroenteritis. This was contradictory

to previous research that demonstrated the influence of sex in relation to digestive disorders (Rakha et al., 2015; Tagorti, 2019; Kouamo et al., 2021), with males being more affected than females.

The significant distribution ($p<0.05$) associated with the geographical distribution of gastroenteritis cases in the city of Lubumbashi where the commune of Lubumbashi, followed by the annex commune and the commune of Kampemba were the most represented (Figure 2). This high frequency of canine gastroenteritis in these communes is thought to result from the fact that in the commune of Lubumbashi, many moderately wealthy households keep dogs much more as pets than for security. In contrast, in Annexe and Kampemba communes, dogs are kept much more for security than as pets. The low frequency in the other communes, particularly Katuba, Kenya, Ruashi, and Kamalondo commune, is thought to be associated with the low purchasing capacity of most of these households to have their dogs examined at a veterinary practice or clinic.

Three main pathologies have been suspected (Table II), canine parvovirus enteritis, helminthiasis and non-specific gastroenteritis. To date, the only method to identify canine gastrointestinal diseases by veterinary practices and clinics in Lubumbashi is the symptomatic diagnosis associated with the epidemiological data (age, vaccination status, breeding mode, community life,...). In the list of clinical signs observed in this study (Figure 4), the first 4 clinical signs (vomiting, inappetence, emaciation and diarrhea) were considered as "warning signs" means signs that motivate the diagnosis of the disease or the earliest clinical signs that alert veterinarians in case of these diseases

Even if the three diseases have in common identical symptoms, the frequency, the intensity of certain symptoms and certain features of anamnesis (age, vaccination and deworming status) allowed to differentiate the canine parvovirus enteritis (hemorrhagic diarrhea and sometimes nauseating, fever, dehydration, pale mucosa, high heart rate and respiratory rate in a young, unvaccinated subject) to non-specific gastroenteritis (vaccinated and adult) to helminthiasis (presence of intestinal worms in the feces. However, it should be noted that the only symptomatic diagnosis used by veterinary clinicians in Lubumbashi does not allow to differentiate canine parvovirus enteritis from non-specific gastroenteritis. The use of the laboratory (rapid tests, autopsy, serology and PCR) is therefore the only method to be able to determine the exact prevalence of gastrointestinal diseases in Lubumbashi (Folitse et al., 2018)

5.0 Conclusion

This study was the first to document the epidemiological data of canine gastroenteritis treated in veterinary practices and clinics in Lubumbashi city during the period from January 2017 to August 2021. It was concluded that non-vaccination, the full dry season, breed and age influenced significantly ($p<0.05$) the prevalence of canine gastroenteritis in Lubumbashi. However, sex did not show a significant difference ($p>0.05$). The prevalence of gastrointestinal diseases recorded (canine parvovirus enteritis, helminthiasis and non-specific gastroenteritis) remains unclear because it is a symptomatic diagnosis, the confirmation of which in the laboratory remains to be clarified. Hence the need for studies on the identification and prevalence of the different pathogens of canine gastroenteritis in Lubumbashi, the determination of their co-infection.

6.0 Recommendations

Based on these results, the authors recommend: (i) to the dog breeders of Lubumbashi on the usefulness of vaccination and deworming of dogs especially during the dry season and (ii) to the

veterinarians, rational management of the clinical records of the patients while encouraging them to practice autopsy and paraclinical examinations.

Acknowledgement

The authors would like to thank the veterinary staff of all the veterinary practices and clinics in the Lubumbashi city. Their contribution has been very important in the realization of this epidemiological survey on canine gastroenteritis.

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