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Effect of vaccination, deworming status, source of adoption and housing pattern on occurrence of canine parvoviral infection in puppies

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Abstract
Management practices of the puppies play a crucial role in occurrence of canine parvoviral infection. The affected dogs void the viral particles in their faeces for many days and act as a major source of viral transmission in spreading of the disease. 50 fecal samples were collected from puppies suggestive of PVGE. LFA and PCR were conducted as a preliminary and confirmatory test for screening CPV antigen in the feces. Present study showed higher occurrence of CPV infection in unvaccinated puppies having outdoor access and no history of deworming, which were adopted from breeders.

Keywords: Canine parvoviral infection, vaccination status, deworming status, source of adoption

1. Introduction
Canine parvovirus infection is one of the most contagious disease of viral aetiology affecting all age group of dogs and most commonly its occurrence is seen in pups causing higher percent mortality. In acute form of disease condition, it is characterised by vomiting, haemorrhagic enteritis with foul odour, dehydration finally leading to death. The affected dogs void the viral particles in their faeces thus acting as a major source of transmission in spreading of the disease. The virus is shed during the acute phase of enteric fever and survives at least for four months in faeces and environment (Carmichael and Binn, 1981) [3]. The most frequently reported risk factor for developing a CPV infection is inadequate protective immunity (Ling *et al*. 2012) [12]. Several factors have been reported to be associated with virus infection, such as free-ranging behaviour (de Almeida Curi *et al*. 2016) [5], overcrowding unsanitary environment (Goddard and Leisewitz, 2010) [7], insufficient anthelminthic prophylaxis (Miranda *et al*. 2015) [13]. Present study was conducted to assess the effect of vaccination, source of adoption, deworming status and housing pattern on the occurrence of canine parvoviral infection in puppies.

2. Materials and Methods
The present study was conducted in Veterinary College Hospital, Department of Veterinary Medicine, Veterinary College Hebbal, Bengaluru, Karnataka. A total of 50 fecal samples were collected from puppies suffering with foul smelling haemorrhagic diarrhoea, vomiting, lethargy and fecal samples were subjected for Lateral flow assay (LFA) (PetX, catalog number JCA002D made by J&G Biotech Ltd (Reg No:08419172), 326 Cleveland Road, London, England E18 2AN, UK) for initial screening and conventional polymerase chain reaction (PCR) for confirmatory diagnosis of CPV antigen in the fecal samples. LFA was conducted as per the manufacturer's guidelines.
Detailed history of puppies, such as vaccination status, source of adoption, deworming status and housing pattern were collected from pet owners on the day of presentation of the puppies to the hospital.

3. Results and Discussion
3.1 Occurrence of CPV infection in puppies based on vaccination status
In the present study, both LFA and PCR results showed that the risk of developing CPV

infection is higher in the unvaccinated puppies compared to vaccinated puppies. Agnihotri *et al*. (2018) [1], Alves *et al*. (2020) [2], Chethan *et al*. (2022) [4] and Harshitha (2024) [8] were also reported higher risk of developing CPV infection in unvaccinated puppies compared to vaccinated puppies. The higher occurrence of CPV infection in unvaccinated (87.09%) puppies may be due to lack of protective immunity against CPV because of lack of the primary vaccination course.

Even with vaccination against CPV, there is a possibility of getting infection, that can be due to declined maternal antibodies or vaccine induced antibodies or vaccine induced antibodies have not reached to protective level or vaccine failure because of interference with maternal antibodies or any other reasons. Ling *et al*. (2012) [12], Pandya *et al*. (2017) [15] and Soliman *et al*. (2018) [18] were also reported the risk of developing CPV infection in puppies of less than 12 month of age despite of vaccination and postulated to failure of the primary vaccination course to provide protective immunity.

Table 1: Occurrence of CPV infection in puppies based on vaccination status

Sl. No.	Vaccination status	Study population (n=50)	LFA	PCR
1	Regularly vaccinated	14	6 (42.86%)	8 (57.14%)
2	Irregularly vaccinated	5	3 (60%)	4 (80%)
3	Never vaccinated	31	18 (58.06%)	27 (87.09%)
	Total	50	27	39

3.2 Occurrence of CPV infection in puppies based on deworming status

The LFA and PCR results showed that the risk of developing CPV infection is higher in puppies which never got deworming medication followed by irregularly dewormed puppies. The higher occurrence of CPV infection in non-dewormed puppies might be because of the concurrent infections by the intestinal parasites. Saravanan and Palanivel (2017) [16], Khare *et al*. (2020) [10], Saravanan *et al*. (2020) [17] were also reported higher incidences of CPV infection in puppies which were never got deworming medication. In contrast, Kalli *et al*. (2010) [9] reported that the puppies that had received partial anthelminthic treatment had 5.78 times higher chance to develop CPV infection compared to the untreated puppies.

Table 2: Occurrence of CPV infection in puppies based on deworming status

Sl. No.	Deworming status	Study population	LFA	PCR
1	Regular	12	4 (33.33%)	5 (41.67%)
2	Irregular	8	4 (50%)	7 (87.50%)
3	Never Done	30	19 (63.33%)	27 (90%)
	Total	50	27	39

3.3 Occurrence of CPV infection in puppies based on source of adoption

The occurrence of CPV infection depending on source of adoption is presented in the Table 3. Based on LFA results, the higher occurrence of CPV infection was found in puppies which were adopted from breeders (15/50, 30%) followed by friends and family (7/50, 14%) puppies and lesser in stray (5/50, 10%) puppies. The occurrence of CPV infection based on PCR results was found higher in puppies which were adopted from breeders (22/50, 44%) followed by friends and family (12/50, 24%%) puppies and lesser in stray (5/50, 10%) puppies.

The higher occurrence of CPV infection in puppies adopted from breeders might be because of overcrowding, unsanitary conditions, improper vaccination schedule, stress, inbreeding, weaning stress or improper fostering at the place of breeding. Khare *et al*. (2020) [10] and Doherty-Odueko (2022) [6] were also reported that puppies from animal shelter or adoption centres were more likely to develop CPE due to exposure to many animals in close proximity under unsanitary confinement.

Table 3: Occurrence of CPV infection in puppies based on sources of adoption

Sl. No.	Sources	Study population	LFA	PCR
1	Abandoned	1	0	0
2	Breeder	31	15 (30%)	22 (44%)
3	Friends and family	13	7 (14%)	12 (24%)
4	Stray	5	5 (10%)	5 (10%)
	Total	50	27	39

3.4 Occurrence of CPV infection in puppies based on housing pattern of the puppies

The details of the housing pattern of the study population were collected from the owners depending on their accessibility to the external environment such as indoor, outdoor and both environments. Out of 50 puppies, 20 (40%) puppies had indoor access, three (6%) puppies had outdoor access and 27 (54%) puppies had both indoor and outdoor access. The occurrence of CPV infection based on housing pattern is presented in the Table 4.

Higher occurrence of CPV infection based on LFA results was found in puppies which had both indoor and outdoor accessibility (14/50, 28%) followed by indoor access (10/50, 20%) and outdoor access (3/50, 6%). Based on PCR results higher prevalence of CPV infection was found in puppies which had both indoor and outdoor accessibility (20/50, 40%) followed by indoor access (16/50, 32%) and outdoor access (3/50, 6%). This is because of exposure of the puppies to unhygienic environment contaminated with CPV antigen or CPV affected dogs and stressful environmental conditions or due to exposure to many animals in close proximity. Mylonakis *et al*. (2016) [14], Khatri *et al*. (2017) [11], Khare *et al*. (2020) [10] and Doherty-Odueko (2022) [6] were reported higher occurrence rates of CPV infection in puppies with outdoor access.

Table 4: Occurrence of CPV infection in puppies based on housing pattern

Sl. No	Housing pattern	Study population (n=50)	LFA (n=27)	PCR (n=39)
1	Indoor	20	10 (20%)	16 (32%)
2	Outdoor	3	3 (6%)	3 (6%)
3	Both (Mixed)	27	14 (28%)	20 (40%)
	Total	50	27	39

4. Conclusion

In conclusion, present study showed higher occurrence of CPV infection in unvaccinated puppies having outdoor access and no history of deworming, which were adopted from breeders.

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