

**Special Issue:**

Emerging and Re-emerging Animal Health Challenges in Low and Middle-Income Countries

The Role of Probiotic Bacteria Administration in the Improvement of Dog Digestion Infected by Canine Parvovirus

NAMEER A. KHUDHAIR^{1*}, DALAL K. RAHI¹, ZAHRAA F. JELOD², FATIMA T. AHMED²¹Department of Veterinary Public Health, College of Veterinary Medicine, University of Basrah, Iraq; ²Undergraduate Students in College of Veterinary Medicine, University of Basrah, Iraq.

Abstract | The current study was designed to evaluate the role of probiotic bacteria in recovery and improvement of canine parvovirus infection after symptomatic treatment. This study involves 12 parvovirus infected dogs diagnosed clinically and their age ranged from 3-6 months and weight between 2-5 kg. Clinical signs were monitored and recorded before and after treatment. Blood samples were collected for complete blood picture measurement. Fecal examinations were performed for pH, fecal occult blood and total bacterial count estimation. The results revealed there were significant improvements ($P < 0.05$) in total WBC count, neutrophils and lymphocytes in animals treated with probiotics additives compared to dogs received symptomatic treatment only. RBC, Hb and HTC showed significant increase in their values for dogs after treatment with probiotics compared to their values before and after 5 days of treatment. The pH stool and fecal occult blood were affected by parvovirus infection and relation with gastrointestinal tract, but after 5 days of treatment the values improved in groups and dogs received probiotics showed better results when compared with the other group of treatment. These belong to the improvement in total bacterial count values that established by estimation of fecal bacteria to appear the obvious improvement in their numbers after 5 days of treatment and probiotics additives.

Keywords | Probiotic, Dog digestion, Canine parvovirus**Received** | July 23, 2024; **Accepted** | November 09, 2024; **Published** | December 05, 2024***Correspondence** | Nameer A. Khudhair, Department of Veterinary Public Health, College of Veterinary Medicine, University of Basrah, Iraq; **Email:** nameer.khudhair@uobasrah.edu.iq**Citation** | Khudhair NA, Rahi DK, Jelod ZF, Ahmed FT (2024). The role of probiotic bacteria administration in the improvement of dog digestion infected by canine parvovirus. J. Anim. Health Prod. 12(s1): 218-222.**DOI** | <https://dx.doi.org/10.17582/journal.jahp/2024/12.s1.218.222>**ISSN (Online)** | 2308-2801**Copyright:** 2024 by the authors. Licensee ResearchersLinks Ltd, England, UK.This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Recently, the culture of breeding small animals in homes has spread in Iraq, and some have taken them as a hobby to breed dogs or cats, in addition to using them for security purposes. As a result, veterinary clinics have been opened to care for small animals and provide their supplies, and amateurs are spending a lot of money to meet needs of these animals. Through observations and follow-up visits to veterinary clinics, it was noted that what breeders spend is often useless when dogs are infected with parvovirus.

Canine parvovirus (CPV) is a highly endemic virus disease in dogs which infected puppies (2-6 weeks old) and adolescences dogs, it is mortality reach for 91% when the required treatment is not given (Goddard *et al.*, 2008). The CPV appeared two different forms, intestinal is most common than cardiac form that characterized by severe bloody diarrhea, lethargy, anorexia, fever, vomiting and severe weight loss (Yilmaz *et al.*, 2005). The main steps for treatment focus on reduce the severity of symptoms (bloody diarrhea and vomiting) to avoid dehydration and prevent secondary bacterial complication (Dogonyaro, 2010). In the

other hand, probiotics as living microorganism established their effect on enhance the immunity status and have the ability to improve intestinal epithelium growth and reduced the virulence of pathogenic bacteria (Zhang *et al.*, 2016).

Giorgio *et al.* (2018) have concluded the role of intestinal microbiota in faster recovery of puppies from diarrhea when they investigate the efficiency of intestinal microbiota on infected puppies with parvovirus. While, Jiang *et al.* (2019) suggested probiotic vaccine to protection against Canine Distemper Virus infection in dog through their evaluation for the immunity status of dogs after vaccinated with probiotics. Therefore, the current study designed to evaluate the role of probiotics in improving and recovery of dogs parvovirus infection through enhancement of immunity status and intestinal epithelium from canine parvovirus disease infection.

MATERIAL AND METHODS

A total of 12 dogs (8 male and 4 female) from German shepherd breed which diagnosed as parvovirus infection by clinical signs (bloody diarrhea, lethargy, loss of appetite, vomiting with fever) in private veterinary clinic (Alfayhaa veterinary clinic). It is age ranged between 3-6 months and their weight ranged (2-5 kg), all of them unvaccinated. According to the type of treatment, dogs are divided into two groups randomly. Group I: CPV infection dogs treated with symptomatic therapy (ringer's fluid, ciprofloxacin, multivitamins). Group II: CPV infection dogs treated with symptomatic therapy and administration of probiotics chew orally (Enteroflora plus, Brupharmexport,Belgium). The blend of probiotics contains *Saccharomyces boulardii*, *Lactobacillus rhamosus*, *Lactobacillus helveticus*, *Bifidobacterium longum*) 20x10⁹ CFU was orally administrated /day for about 5 days.

Clinical signs were monitors and recorded for all animals from the first day before treatment and also recorded after 5 days of treatment. Blood and feces were collected for 2 intervals (before treatment and day 5 of treatment). Blood sample were collected by using disposable syringe (5 ml)

through cephalic vein and put in tube contain EDTA for hematology analysis (RBC,Hb,PCV,WBC and differential WBC) that done by using auto-analyzer hematology device (Exigo H400, Sweden). While fecal examination includes total microbial account, fecal occult blood and PH. Colonies of bacteria were counted at the appropriate dilution using a colony counter and counted the number of bacteria per milliliter by multiplying (number of colonies x reciprocal of the dilution) according to (Lankaputhra *et al.*, 1995). The fecal PH value were recorded by using universal indicator paper 1-14, while fecal occult blood determined by using rapid FOB test kit, China.

RESULTS AND DISCUSSION

The clinical signs of parvovirus infected dogs improved gradually after the animal received treatment. As shown in Table 1, there were obvious improvements in dogs treated with or without probiotics bacteria. The appetite and lethargy appeared normal in dogs treated with symptomatic probiotics treatment compared to dogs symptomatic- treated.

The status of leukocytes in CPV infection (Table 2) revealed the role of probiotics bacteria administration in improve the immunity status of infected animal by showing significant increase (P<0.05) in total WBC count, neutrophils and lymphocytes compared with dogs treated without administration of probiotic bacteria. The count of monocytes, eosinophil and basophils appeared non-significant difference (P<0.05) between the groups.

The hematological indices showed significant elevation (P<0.05) of RBC, HB, HCT and MCV for the CPV infected animals that received treatment compared the first day of infection before treatment (Table 3). The animal that taken probiotics bacteria in their treatment showed significant increase (P<0.05) in their values of RBC, HB, HCT and MCV compared to CPV infected animal did not received probiotics in their treatment (Table 3). While MCH, MCHC and platelets showed non-significant differences between the animals treated with or without administration of probiotics.

Table 1: Clinical signs of CPV infected received treatment with and without probiotics.

Parameters	CPV+sys. treatment		CPV+Sys. Treatment +probiotic	
	Before treatment	After 5 day of treatment	Before treatment	After 5 day of treatment
Appetite	Severely reduced	Mild reduced	Severely reduced	Normal
Lethargy	Sever	Mild reduced	Sever	Normal
Vomiting	Moderately	No vomit	moderately	No vomit
Temperature	Increase to fever	normal	Increase to fever	Normal
bloody diarrhea	Sever	No bloody diarrhea	Sever	No bloody diarrhea

Table 2: Role of probiotics bacteria on total and differential leukocytes in canine parvovirus infection.

Parameters	CPV+sys. treatment		CPV+Sys. Treatment +probiotic	
	Before treatment	After 5 day of treatment	Before treatment	After 5 day of treatment
WBC x10 ³ /μl ²	4.53 ± 0.37 C	6.42 ± 0.82 B	3.86±0.65 C	9.22 ± 1.83 A
Neutro. x10 ³ /μl ²	1.92 ± 0.54 C	3.51± 0.72 B	1.84±0.84 C	4.36 ± 0.97 A
Lymph.x10 ³ /μl	0.45 ± 0.18 C	1.92 ± 0.22 B	0.52 ± 0.12 C	3.17 ± 0.94 A
Mono. x10 ³ /μl	0.24±0.08	0.28 ± 0.07	0.26± 0.08	0.31 ± 0.09
Eosino. x10 ³ /μl	0.22 ± 0.06	0.26 ± 0.06	0.27 ± 0.04	0.29 ± 0.07
Baso. x10 ³ /μl	0.04 ± 0.02	0.03± 0.01	0.03± 0.01	0.04± 0.01

Capital letter referred horizontally to significant differences at (P<0.05).

Table 3: Role of probiotics bacteria on blood components in canine parvovirus infection.

Parameters	CPV+sys. treatment		CPV+Sys. Treatment +probiotic	
	Before treatment	After 5 day of treatment	Before treatment	After 5 day of treatment
RBCs x10 ³ /μl	3.61±0.93 C	5.57 ± 1.42 B	3.67±1.52 C	7.81 ± 1.83 A
HB g\dl	10.27± 2.92 C	12.46 ± 2.65 B	11.87±3.48BC	17.63 ± 2.76 A
HCT %	34.57± 5.82 C	42.93 ± 4.73 B	36.66± 6.24 C	55.18 ± 6.92 A
MCV fL	62.32±6.82 B	59.84 ± 7.33 B	56.48 ± 4.29 B	72.13 ± 8.37 A
MCH pg	21.54±2.71	20.45± 3.69	22.94±4.38	24.26±4.78
MCHC g\dl	25.72 ±3.46	24.24± 2.86	26.25 ± 4.74	28.36± 4.29
Platelate x10 ³ /μl	150.76 ±20.33	147.65± 17.53	148.83 ± 18.75	151.34± 15.30

Capital letter referred horizontally to significant differences at (P<0.05).

Table 4: Role probiotics bacteria on total bacterial account, PH and fecal occult blood in feces of CPV dogs.

Parameters	CPV+sys. treatment		CPV+Sys. Treatment +probiotic	
	Before treatment	After 5 day of treatment	Before treatment	Day 5 After 5 day of treatment
PH (mean)	5.15± 0.61 C	6.13± 0.33 B	5.21± 0.78 C	6.72± 0.64 A
Fecal occult blood	+++	+	+++	Negative
Total bacterial account log. cfu/ml	5.88 ± 0.82 C	7.23±0.06 b	4.73 ± 0.76 C	9.16±0.42 A

Capital letter referred horizontally to significant differences at (P<0.05).

The samples of feces for CPV infected dogs were analyzed to record PH, fecal occult blood and total bacterial account (Table 4). The results appeared decreased PH value in dogs infected with parvovirus and treated without probiotics addition compared with infected dogs treated with probiotics that appear improvement in PH value of their feces. Also, in dogs infected with parvovirus and systemic treated without probiotics addition found blood in feces comparison with dogs that recorded negative signs for dogs treated and received probiotics.

The total bacterial account in feces were show and significant increase (P<0.05) in group of dogs after 5 days of treatment and received probiotics compared with group of dogs treated without probiotics addition and before treatment.

Canine parvovirus (CPV) enteritis is a common contagious viral disease that affects the puppies at age 6 weeks to 6

months (McCaw and Hoskins, 2006). The onset of disease began after some days of infection and represented by vomiting and diarrhea and gradually progress to fever, loss appetite, lethargy, depression and hemorrhagic diarrhea with a mortality rate around 90% (Lamm and Rezabek, 2008). Therefore, the present study designed to find supportive treatment for infected dogs and reduce the mortality rate of animals infected with CPV.

The clinical signs in the present study showed recovery of dogs after 5 days treatment with or without probiotics, and the group of dogs received probiotics in their treatment appeared better signs compared the other treated group. Several studies showed an improvement in clinical signs by probiotic treatment such as causing significant decreased incidence of diarrhea in sheltered dogs and a significant reduction in duration of uncomplicated acute diarrhea in dogs (Kelley *et al.*, 2009; Rose *et al.*, 2017). Other study investigated the effect of probiotic used in treatment of

hemorrhagic diarrhea due to parvovirus infection through rapid reducing the severity of signs and regulates WBC count (Arslan et al., 2012).

Effect of probiotic treatment on clinical course was investigate by compared with placebo treatment and found rapid clinical improvement in dogs which were treated with probiotic from acute hemorrhagic diarrhea (Ziese et al., 2018).

The analyzed date in Table 2 referred to significant decrease in total WBC, neutrophils and lymphocyte in infected dogs, these results agreed with Terzungwe (2018) and Goddard et al. (2008) that recorded the values of total and differential WBC in parvovirus infected dogs decreased due to CPV infection. The reasons for the decrease in total and differential leukocyte attributed to viral attack the bone marrow and lymph node to destroy the immune defense system of dogs and invasion the gastrointestinal tract easily (Voorhees et al., 2019).

The results showed improvement in total and differential leukocytes after symptomatic treatment. The additive of probiotic bacteria as well as symptomatic treatment to the animals revealed significant elevation in total WBC, neutrophils and lymphocytes compared with animal received symptomatic treatment only. Camargo et al. (2006) had recorded beneficial effect of the probiotic product in reducing the mortality rate in puppies suffered from hemorrhagic gastroenteritis. In other study investigated the role of probiotic product administration with treatment in improvement of leukocyte and lymphocyte in CPV infection (Arslan et al., 2012). The previous results data showed that probiotic bacteria have phagocytic neutrophil ability and competitive the other pathogenic bacteria lead to enhancement of immune defense mechanism of the body (Elliott, 2006).

Hematological parameters are one of the important indicators for the healthy status of animals. Especially, in case of CPV infection due to the hemorrhagic diarrhea that occur on dogs. As the results revealed, there was anemia and decrease in RBC, Hb, HCT and MCF in most of infected dogs. This finding is agree with Kalli et al. (2010) and Sykes (2014), Terzungwe (2018). Whereas, symptomatic treated animal with or without probiotic additives showed fast recovery for the hematological parameters after 5 days of treatment. In contrast, the dogs that treated with probiotic bacteria showed better improvement in their indices and that may be belong to the role of probiotic in endotoxin concentrations reduction in serum and decrease of erythrocyte fragility with improvement of immune status of animal. These changes are remove the effect of virus on bone marrow and recovery of blood indices through bone marrow production (Strompfová et al., 2006).

The results of Table 4 had good recovery indication when uses probiotic with traditional treatment of infected with parvovirus. The ameliorative effect of probiotic appeared clearly on fecal PH values and occult blood test compared with the same animal before treatment. Also, total bacterial account showed significant increase after treated animals, this in turn on enhancement of immunity and repair the destroyed intestinal epithelium due to virus infection.

Arslan et al. (2012) investigate the role of probiotic in reducing the mortality rate and increase the survive of puppies infected with parvovirus after symptomatic treatment. Desrochers et al. (2005) have reported that *Saccharomyces boulardii* might help to decrease the severity and duration of clinical signs in horses with acute enterocolitis. Furthermore, in dogs, probiotic *Enterococcus faecium* has been reported to reduce fecal numbers of *Cl. perfringens* and stimulate immune functions (Westermarck et al., 2005). Other studies referred to the role of probiotic treatment in case of diarrhea in dogs. Also, Ziese et al. (2018) concluded that used of probiotic treatment accelerate of intestinal epithelium recovery and balance microbiome in dogs suffered from acute hemorrhagic diarrhea.

CONCLUSION

The present study can recommend use of probiotic bacteria with symptomatic treatment to shortening the recovery period and enhancement the immunity status of canine parvoviral infection.

ACKNOWLEDGEMENTS

We extend our sincere thanks and gratitude to the Deanship of the College of Veterinary Medicine for providing the opportunity to present this modest work to the scientific reader.

NOVELTY STATEMENT

Novelty in this study focusing on role of a probiotic as a primary treatment in case of parvovirus infection in dogs, and its role in improvement of digestion and microbiota of small intestine.

AUTHOR'S CONTRIBUTION

All authors contributed equally to the completion of this work.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

- Arslan HH, Saripinar Aksu D, Terzi G, Nisbet C. Therapeutic effects of probiotic bacteria in parvoviral enteritis in dogs. *Rev Med Vet-Toulouse*. 2012;2(163):55–9
- Camargo PL, Ortolani MBT, Uenaka SA, Motta MB, Dos RBC, Dos SPC, Silva DAJC, Vieira VG, Alfieri AF (2006). Evaluation of the therapeutic supplementation with commercial powder probiotic to puppies with hemorrhagic gastroenteritis. *Sem. Agric. Sci.*, 27: 453–462. <https://doi.org/10.5433/1679-0359.2006v27n3p453>
- Desrochers AM, Dolente BA, Roy MF, Boston R, Carlisle S (2005). Efficacy of *Saccharomyces boulardii* for treatment of horses with *Acute enterocolitis*. *J. Am. Vet. Med. Assoc.*, 27: 954–959. <https://doi.org/10.2460/javma.2005.227.954>
- Dogonyaro, B.B. (2010) Molecular Characterization of Canine Parvovirus Strains from Domestic Dogs in South Africa and Nigeria. M.Sc. Thesis, Department of Veterinary Tropical Disease, University of Pretoria, Pretoria, 1–106.
- Elliott DA (2006). Nutritional considerations for the gastrointestinal patient. *Bull. Acad. Vét. France*, 159: 343–348. <https://doi.org/10.4267/2042/47853>
- Giorgio Q, Pereira LA, Gomes IS, Santos AF, Alfieri JS, Weese, Marcio CC (2018). Fecal microbiota transplantation in puppies with canine parvovirus infection. *J. Vet. Int. Med.*, 32: 707–711. <https://doi.org/10.1111/jvim.15072>
- Goddard A, Leisewitz AL, Christopher MM, Duncan NM, Becker PJ (2008). Prognostic usefulness of blood leukocyte changes in canine parvoviral enteritis. *J. Vet. Intern. Med.*, 22: 309–316. <https://doi.org/10.1111/j.1939-1676.2008.0073.x>
- Kalli I, Leontides LS, Mylonakis ME, Adamama-Moraitou K, Rallis T, Koutinas AF (2010). Factors affecting the occurrence, duration of hospitalization and final outcome in canine parvovirus infection. *Res. Vet. Sci.*, 89(2): 174–178. <https://doi.org/10.1016/j.rvsc.2010.02.013>
- Jiang Y, Jia S, Zheng D, Li F, Wang S, Wang L, Qiao X, Cui W, Tang L, Xu Y, Xia X, Li Y. (2019). Protective Immunity against Canine Distemper Virus in Dogs Induced by Intranasal Immunization with a Recombinant Probiotic Expressing the Viral H Protein. *Vaccines (Basel)*. 2019 Dec 10;7(4):213. doi: 10.3390/vaccines7040213
- Kelley RL, Minikhiem D, Kiely B, O'Mahony L, O'Sullivan D, Boileau T, Park JS. (2009). Clinical benefits of probiotic canine-derived *Bifidobacterium animalis* strain AHC7 in dogs with acute idiopathic diarrhea. *Vet. Ther.*, 10(3): 121–30.
- Lamm CG, Rezabek GB (2008). Parvovirus infection in domestic companion animals. *Vet. Clin. North Am. Sm. Anim. Pract.*, 38(4): 837–850. <https://doi.org/10.1016/j.cvs.2008.03.008>
- Lankaputhra, W.E.V., N.P. Shah (1995). Survival of *Lactobacillus acidophilus* and *Bifidobacterium* spp. in the presence of acid and bile salts. *Cult. Dairy Prod. J.*, 30, pp. 2–7.
- McCaw DL, Hoskins JD (2006). Canine viral enteritis. In: (eds. C.E. Green). *Infectious diseases of the dog and cat*. 4th ed. St Louis, MO: Saunders, pp. 63–73.
- Rose L, Rose J, Gosling S, Holmes M (2017). Efficacy of a probiotic-prebiotic supplement on incidence of diarrhea in a dog shelter: A randomized, double-blind, placebo-controlled trial. *J. Vet. Int. Med.*, 31(2): 377–382. <https://doi.org/10.1111/jvim.14666>
- Strompfová V, Marcináková M, Simonová M, Bogovic-Matijasić B, Lauková A (2006). Application of potential probiotic *Lactobacillus fermentum* AD1 strain in healthy dogs. *Anaerobe*, 12: 75–79. <https://doi.org/10.1016/j.anaerobe.2005.12.001>
- Sykes JE (2014). Canine parvovirus infections and other viral enteritides. In: (eds. J.E. Sykes). *Canine and feline infectious diseases*. 1st ed. St Louis, MO: Elsevier, pp. 141–151. <https://doi.org/10.1016/B978-1-4377-0795-3.00014-4>
- Terzungwe TM (2018). Hematological parameters of dogs infected with canine parvovirus enteritis in sumy Ukraine. *World J. Innov. Res.*, 5(3): 1–5.
- Voorhees IEH, Lee H, Allison AB, Lopez-Astacio R, Goodman LB, Oyesola OO, Omobowale O, Fagbohun O, Dubovi EJ, Hafenstein SL, Holmes EC, Parrish CR. Limited ID (2019). Background evolution accompany 40 years of canine parvovirus host adaptation and spread. *J. Virol.*, 12: 94. <https://doi.org/10.1128/JVI.01162-19>
- Westermarck E, Skrzypczak T, Harmoinen J, SteiNer JM, Ruaux CG, Williams DA, Eerola E, Sund BP, Rinkinen M (2005). Tylosin-responsive chronic diarrhea in dogs. *J. Vet. Int. Med.*, 19: 177–186. <https://doi.org/10.1111/j.1939-1676.2005.tb02679.x>
- Yilmaz Z, Pratelli A, Torun S (2005). Distribution of antigen types of canine parvovirus type 2 in dogs with hemorrhagic enteritis in Turkey. *Turk Vet. Hayvancilik Dergisi*, 29: 1073–1076.
- Zhang Y, Li L, Guo C, Mu D, Feng B, Zuo X, Li Y. 2016. Effects of probiotic type, dose and treatment duration on irritable bowel syndrome diagnosed by Rome III criteria: A meta-analysis. *BMC Gastroenterol.*, 6: 62. <https://doi.org/10.1186/s12876-016-0470-z>
- Ziese, AL, Suchodolski, JS, Hartmann K, Busch K, Anderson A, Sarwar F, Sindern N, Unterer S (2018). Effect of probiotic treatment on the clinical course, intestinal microbiome, and toxigenic *Clostridium perfringens* in dogs with acute hemorrhagic diarrhea. *PLoS One*, <https://doi.org/10.1371/journal.pone.0204691>