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RESEARCH ARTICLE

Investigation of prevalence and risk factors of Parvovirus infection in dogs in Erzurum province, Turkey

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Türkiye'nin Erzurum ilinde köpeklerde Parvovirüs enfeksiyonunun prevalansı ve risk faktörlerinin araştırılması

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Öz

Amaç: Bu çalışma Atatürk Üniversitesi Hayvan Hastanesine getirilen ve barınakta bakılan köpeklerde kanin parvovirüsün (CPV) prevalansını ve risk faktörlerini araştırmayı amaçladı.

Gereç ve Yöntem: Örnekler CPV enfeksiyonunun klinik bulgularını gösteren barınakta bakılan 83 köpek ve hayvan hastanesine getirilen 17 köpekten elde edildi. Hızlı testle incelenen 100 köpeğin 40'ının dışkı örneği (%40) CPV varlığı için pozitifti ve 60 dışkı örneği (%60) negatifti.

Bulgular: Bu çalışmada CPV varlığı ve aşılama durumu, barınma yeri, barınma ortamının temizlenme sıklığı, antelmentik sağaltımı ayrıca iştahsızlık, kusma, dehidrasyon ve karın ağrısı bulguları arasında önemli ilişkinin olduğu belirlendi.

Öneri: Bu çalışmada bütün köpekler gençti (1.5-7.5 aylık yaş aralığında) ve ev ve bahçe dışında serbest dolaşan sokak köpekleriyle temasları vardı. Dolayısıyla sokak köpekleriyle temas, CPV prevalansının yüksek olmasında önemli rolü olabilir. Ayrıca Erzurum ilinde CPV enfeksiyonunun yaygın dolaşımı ve risk faktörleri dikkate alınarak etkili korunma uygulamalarının gerçekleştirilmesi gerekir.

Anahtar kelimeler: Kanin parvovirüs, prevalans, risk faktörleri

Abstract

Aim: This study aimed to investigate the prevalence and risk factors of canine parvovirus (CPV) infection in dogs that were presented to Animal Hospital of Atatürk University and housed in shelter.

Materials and Methods: The samples were obtained from 83 dogs kept animal shelter and 17 dogs presented animal hospital showing clinical signs of CPV infection. The 40 stool samples of 100 dogs (40%) examined by the rapid test were positive for the presence of CPV, and the 60 stool samples (60%) were negative.

Results: In this study, it was determined that there was an important association between the presence of CPV and vaccination status, housing place, cleanliness frequency of housing place, anthelmintic treatment as well as anorexia, vomiting, dehydration and abdominal pain findings.

Conclusion: All the dogs in this study were young (1.5 to 7.5 months' age range) and had contact with free-roaming stray dogs outside the house and garden. Thus, contact with stray dogs might play an important role in the increased prevalence of CPV. Also, the effective prevention practices should be implemented considering risk factors and common circulation of CPV infection in Erzurum province.

Keywords: Canine parvovirus, prevalence, risk factors

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Introduction

Canine parvovirus (CPV-2) is a member of the genus parvovirus, within the family parvoviridae, and a worldwide spread (Decaro et al 2011, Decaro and Buonavoglia 2012, Khatri et al 2017). CPV-2 is a small, non-enveloped, single-stranded DNA virus (Decaro and Buonavoglia 2012). Viral variants are CPV-2a, -2b or -2c (de Oliveira et al 2019). Dogs with CPV infection shed numerous virus particles especially via feces after starting of clinical signs (Ogbu et al 2021). Transmission occurs by fecal-oral, nasal route, and environmental contamination (Greene 2012, Behdenna et al 2019, Rota et al 2019). The vitality of CPV-2 in the environment can be more than one year and dogs may be exposed to the infected material in the environment (Rota et al 2019).

CPV enteritis is a viral disease that threatens the life of puppies and can be fatal (Cavalli et al 2014, Kelman et al 2020). CPV-2 causes symptoms such as fever, loss of appetite, diarrhea (bloody or not), vomiting, depression, lethargy, and leucopenia (Cavalli et al 2014, Mira et al 2018, Gamage et al 2020). In addition, CPV-2 causes myocardial damage (Ford et al 2017).

Diagnosis is made by immune-chromatographic test, PCR, immunoelectron microscopy, hemagglutination and virus isolation (Decaro and Buonavoglia 2012). Immunochromatography is the most common, sensitive, specific and rapid diagnostic technique (Ogbu et al 2021).

Some CPV risk factors include young age, gender, insufficient vaccinations, and season (Qi et al 2020, Kelman et al 2020).

The study aimed to investigate the prevalence and risk factors of parvovirus infection in dogs that were presented to Atatürk University Faculty of Veterinary Medicine, Animal Hospital and housed in a shelter in Erzurum, Turkey.

Material and Methods

Ethical approval

This study was approved by Ethics Committee of Atatürk University (27.11.2021/244). In addition, this study was funded by Atatürk University Scientific Research Project Coordination Unit (TYL-2022-10249).

Animal material

The study included 100 dogs showing the symptoms of CPV infection. They were provided from Atatürk University Faculty of Veterinary Medicine, Animal Hospital and by arriving to Erzurum Metropolitan Municipality Animal Care and Rehabilitation Centre in 2021-2022. These dogs from Animal Hospital (17), from animal shelter (83) were male and female, mixed breed, Aksaray malaklisi, Alabay, German shepherd, Cane Corso, Golden retriever, Husky, Pekingese, Rottweiler and Kangal breeds. The dog owners reported that mixed vaccine had been used for their dogs infected with CPV and adult dogs. Health problem for adult dogs living together with dogs infected with CPV kept in house was not reported by the owners.

Collection of fecal samples

Rectal fecal samples were collected with swabs from the dogs included in this study. The collected swab samples were stored in the deep freezer at -20°C until analysis. An immunochromatographic test kit (Asan Easy Test® Parvo Canine Parvovirus Antigen (CPVAg) Test, Korea) was used to detect CPV-2 antigen in fecal samples.

CPV clinical signs and risk factors

Diarrhea (with or without blood), vomiting, weakness, anorexia, emaciation, dehydration, abdominal pain and rectal temperature (normal, high, low) in the study dogs were noted according to the physical examination. In addition, the risk factors for CPV such as gender (female, male), vaccination status (unvaccinated, vaccinated, unknown), anthelmintic treatment, contact with other dogs, the place that they lived (house, shelter place), housing conditions (dogs together or separately), cleanliness frequency of the housing environment (daily, weekly), and access to veterinary services were noted. Normal rectal temperature values in dogs were 38-39.2 °C (Ramsey and Tasker 2017).

Analysis of fecal samples

Asan Easy Test® Parvo (Asan Pharmaceutical Co., Ltd, Korea) was used to diagnose CPV disease in the dogs, and all the analyses were performed according to the kit's procedure. The swab samples were frozen in the deep freezer at -20 °C. Before the analysis, the fecal samples and the test kits were allowed to room temperature. The fecal samples were mixed with the analysis solution and vortexed (WN – 2800Vortex Mixer, Serial No: PL 028792). Three to four drops (approximately 100 µL) of the fecal samples dissolved in the analysis solution were added to the sample well using a disposable dropper and the test results were interpreted within 5-10 minutes. The formation of a single band in the control (C) line was considered CPV negative. The presence of bands on both of the test line (T) and the control line (C) was considered CPV positive. The fecal samples were not examined for parasite eggs.

Statistics analysis

Statistical analysis was carried out using SPSS v20 (SPSS Inc.,

Chicago, IL, USA). Descriptive statistics were used to describe the prevalence of canine parvovirus. The associations between CPV presence and the risk factors were analyzed with the chi-square test.

Results

Forty percent (40%) of the fecal samples of 100 dogs examined with the rapid test kit were found to be positive for the presence of CPV antigen while 60 (60%) were determined negative. Risk factors were presented in Table 1 and 2.

Risk factors

Gender distribution

The prevalence of CPV was 46% (23/50) in male dogs and 34% (17/50) in female dogs. There was no significant association (p = 0.221) between the presence of CPV and gender distribution.

Vaccination status

The prevalence of CPV was 50% (2/4) in vaccinated dogs, 92.3% (12/13) in unvaccinated dogs, and 31.3% (26/83) in dogs with unknown vaccination. Therefore, there was a significant association (p = 0.000) between the presence of CPV and vaccination status.

Housing place

The prevalence of CPV was 82.4% (14/17) in dogs kept in house and 31.3% (26/83) in dogs kept in animal shelter. There was a significant association between the prevalence of CPV and housing place (p = 0.000).

Cleanliness frequency of the housing environment

The prevalence of CPV according to cleaning frequency was 100% (5/5) once in 2 days, was 50% (1/2) once in 3 days, 87.5% (7/8) once a day, and 31.8% (27/85) twice a day. There was a significant association (p = 0.000) between the presence of CPV and cleanliness frequency of the housing environment.

Housing conditions (dogs together or separately)

The prevalence of CPV was 66.7% (6/9) in dogs kept separate and 37.4% (34/91) in dogs kept together. There was no important association (p = 0.089) between the presence of CPV and housing conditions.

Anthelmintic treatment

The prevalence of CPV among those taking anthelmintic treatment was 46.6% (34/73) while the prevalence among those not taking anthelmintic treatment was 22.2% (6/27). There was a strong association (p = 0.027) between the prevalence of CPV and anthelmintic treatment.

Clinical findings

Body temperature

The prevalence of CPV was 27.3% (3/11) in dogs with low body temperature, 43.9% (25/57) in dogs with normal body temperature, and 37.5% (12/32) in dogs with high body temperature. There was no significant association (p = 0.554) between the presence of CPV and body temperature.

Diarrhea

The prevalence of CPV was 42.9% (21/49) in dogs with bloody diarrhea, 31.8% (14//44) in dogs with nonblood diarrhea, and 71.4% (5/7) in dogs with no diarrhea. There was no significant association (p = 0.108) between the presence of CPV and diarrhea.

Vomiting

The prevalence of CPV was 32.5% (26/80) in dogs with unknown vomiting, 69.2% (9/13) in dogs with vomiting, and 71.4% (5/7) in dogs without vomiting. There was a significant association (p = 0.008) between the presence of CPV and vomiting.

Weakness

The prevalence of CPV was 43.6% (34/78) in dogs with weakness, and 27.3% (6/22) in dogs without weakness. There was no significant association (p = 0.168) between the presence of CPV and weakness.

Emaciation

The prevalence of CPV was 42.3% (33/78) in dogs with emaciation, and 31.8% (7/22) in dogs without emaciation. There was no significant association (p = 0.375) between the presence of CPV and emaciation.

Anorexia

The prevalence of CPV was 31.3% (26/83) in dogs with unknown anorexia, and 82.4% (14/17) in dogs with anorexia. There was a significant association (p = 0.000) between the prevalence of CPV and anorexia.

Dehydration

The prevalence of CPV was 43.3% (39/90) in dogs with dehydration, and 10% (1/10) in dogs without dehydration.

Table 1. Prevalence and Risk Factors of CPV Based on Gender, Vaccination Status, Housing Place, Cleanliness Frequency of the Housing Environment, Housing Conditions and Anthelmintic Treatment in Dogs in Erzurum Province

Parameters	Category	Positive	Negative	Total	Prevalence (%)	P value
Gender	Male	23	27	50	46.0	0.221
	Female	17	33	50	34.0	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 1.500
Vaccination status	Vaccinated	2	2	4	50.0	0.000
	Unvaccinated	12	1	13	92.3	
	Unknown	26	57	83	31.3	Fisher's exact test = 17.810
	Total	40	60	100	40.0	
Housing place	Shelter	26	57	83	31.3	0.000
	House	14	3	17	82.4	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 15.308
Cleanliness frequency of the housing environment	Once in 2 days	5	0	5	100.0	0.000
	Once in 3 days	1	1	2	50.0	
	Once per day	7	1	8	87.5	Fisher's exact test = 17.079
	Twice a day	27	58	85	31.8	
	Total	40	60	100	40.0	
Housing conditions	Separate	6	3	9	66.7	0.089
	Together	34	57	91	37.4	df = 1
	Total	40	60	100	40.0	Pearson chi-square = 2.980
Anthelmintic treatment	Yes	34	39	73	46.6	0.027
	No	6	21	27	22.2	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 4.871

There was a significant association (p = 0.047) between the presence of CPV and dehydration.

Abdominal pain

The prevalence of CPV was 52.3% (23/44) in dogs with abdominal pain, and 30.4% in dogs without abdominal pain (17/56). There was a significant association (p = 0.026) between the presence of CPV and abdominal pain.

Discussion

This study determined that CPV prevalence in young dogs (1.5 to 7.5 month old dogs) was at a rate of 40% in Erzurum

Table 2. Prevalence and Risk Factors of CPV in Based on Clinical Signs in Dogs in Erzurum Province

Parameter	Category	Positive	Negative	Total	Prevalence (%)	P value
	Low	3	8	11	27.3	0.554
Body temperature	Normal	25	32	57	43.9	df = 2
	High	12	20	32	37.5	
	Total	40	60	100	40.0	Pearson chi-square value=1.180
Diarrhea	Bloody	21	28	49	42.9	0.108
	No blood	14	30	44	31.8	
	No diarrhea	5	2	7	71.4	
	Total	40	60	100	40.0	Fisher's exact test = 4.126
Vomiting	Unknown	26	54	80	32.5	0.008
	Yes	9	4	13	69.2	
	No	5	2	7	71.4	
	Total	40	60	100	40.0	Fisher's exact test = 9.056
Weakness	Yes	34	44	78	43.6	0.168
	No	6	16	22	27.3	df = 1
	Total	40	60	100	40.0	Pearson chi-square test = 1.904
Emaciation	Yes	33	45	78	42.3	0.375
	No	7	15	22	31.8	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 0.787
Anorexia	Unknown	26	57	83	31.3	0.000
	Yes	14	3	17	82.4	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 15.308
Dehydration	Yes	39	51	90	43.3	0.047
	No	1	9	10	10.0	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 4.167
Abdominal pain	Yes	23	21	44	52.3	0.026
	No	17	39	56	30.4	df = 1
	Total	40	60	100	40.0	Pearson chi-square value = 4.931

province of Turkey. In addition, according to authors knowledge, it is a first detailed CPV risk factor study in young dogs showing CPV clinical signs in Turkey. The prevalence of CPV in various countries around the world was determined to be 58.1% in 116 dogs with diarrhea in Greece (Kantere et al 2021), 58% in 355 dogs with diarrhea in the United Kingdom (Godsall et al 2010), 70.42% in 71 dogs with acute diarrhea in South America (Duque-Garcia et al 2017), 84% in 50 dogs with diarrhea in Egypt (Elbaz et al 2021), 45% in 320 dogs with gastroenteritis in North Central Nigeria (Ogbu et al 2021), 55.7% in 61 dogs with parvoviral clinical signs in China (Hao et al 2020), 32.14% in 168 dogs with diarrhea in Tunisia (Tagorti 2018), 77.5% in 209 dogs with parvoviral clinical signs in Portugal (Miranda et al 2015), and 40.85% in dogs with diarrhea in India (Behera et al 2015). In Turkey, CPV prevalence was reported to be 35% in 60 dogs with hemorrhagic diarrhea in Bursa province (Yılmaz et al 2005), and 76.3% in 93 dogs with diarrhea in Kars province (Yılmaz 2020). Thus, in Turkey and in the world, the presence of CPV appeared to be common in dogs.

In this study, CPV-infected dogs were about 1.5 to 7.5 months old. This study was consistent with the other studies that reported a high prevalence of CPV disease in dogs younger than 6 months of age (Behera et al 2015, Gamage et al 2020, Elbaz et al 2021).

This study determined that the prevalence of development of CPV infection was higher in dogs receiving anthelmintic treatment than dogs not receiving anthelmintic treatment. This study results were consistent with of the results Kalli et al (2010) but contrast to the results of Miranda et al. (2015). Accordingly, the results of this study have shown that the prevalence of CPV disease might also be high in dogs receiving anthelmintic treatment. In the dogs treated with anthelmintic treatment compared to the dogs not treated with anthelmintic treatment, increased CPV prevalence might be attributed to the higher rate exposure of CPV infection.

The findings of this study found that there was an important association between vaccination status and CPV infection, and that the prevalence of CPV disease was high in unvaccinated dogs. Godsall et al (2010) and Terzungwe et al (2018) have revealed that the presence of CPV is higher in unvaccinated dogs than vaccinated dogs. However, Ogbu et al (2021) have found that there is no association with CPV presence between vaccinated (42.07%) and unvaccinated (48.08%) dogs. CPV presence in vaccinated dogs can be attributed to the presence of maternal antibodies in puppies, inappropriate vaccinations, and poor response to vaccinations (Ogbu et al 2021).

It was found that the CPV prevalence in this study was not associated with gender, and that CPV infection was higher in males (46%) than 34% in females. In other studies, Ogbu et al (2021) have found that there was not any important association with the presence of CPV and gender distribution, but CPV prevalence was higher in females (48.87%) than in males (42.25%). Elbaz et al (2021) have found that there was an important association with CPV presence and gender and that CPV presence in dogs is higher in male dogs than female dogs. Detection of differences in CPV prevalence by gender in the studies may be related to CPV exposure and immune responses of males and females.

In this study, it was determined that there was an important association between the presence of CPV and the housing place, and the presence of CPV and the cleanliness frequency of the housing environment. Even in the case of frequent cleaning of housing environment and keeping dogs in the home, CPV prevalence was high. All of the study dogs were outdoor access. Thus, this event might be attributed to walking outdoor and contact with other stray dogs possibly infected.

In this study, Aksaray malaklisi, Cane Corso, Husky, Pekingese, Rottweiler, Kangal breed dogs with CPV positive had owner, were kept in house, and had CPV clinical signs. Alabay, German Shepherd, and Golden Retriever had negative CPV test. Houston et al. (1996) have stated that Rottweiler, American Pitbull Terrier, Doberman Pinscher and German Shepherd dogs are at higher risk for CPV infection. In addition, this study revealed that mixed breed dogs with CPV clinical signs had CPV infection at 33.7%. This increased rate may reveal increased infection distribution in Erzurum province. In addition, negative CPV test in Alabay, German Shepherd, and Golden Retriever dogs in this study might be attributed to no exposure to CPV infection and immune response.

This study has revealed that among the risks of CPV clinical findings, anorexia (p=0.000), vomiting (p=0.008), dehydration (p= 0.04) and abdominal pain (p= 0.02) were importantly associated with the presence of CPV, and body temperature (p=0.55), diarrhea (p=0.10), weakness (p=0.16), emaciation (p=0.37) were not importantly associated with the presence of CPV. Miranda et al. (2015) have reported that depression, dehydration, vomiting and body condition were importantly associated with CPV presence.

Conclusion

This study determined that vaccination, housing place, cleanliness frequency of housing place, anthelmintic treatment, vomiting, anorexia, dehydration, abdominal pain was important risk factors in CPV infection. In this study, all the study dogs were young, outdoor access and contact with free-roaming stray dogs. Thus, the effective prevention practices, such as collection of dog feces, cleaning and disinfection of the environment, implementation of vaccination programs, and prevention of contact with unvaccinated dogs, should be implemented due to common circulation of CPV infection in Erzurum province.

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Conflict of Interest

The authors did not report any conflict of interest.

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Author Contributions

Motivation / Concept: BH, WFAI; Design: WFAI, BH; Control/

Supervision: WFAI, BH; Data Collection and / or Processing: BH, WFAI; Analysis and / or Interpretation: BH, WFAI; Literature Review: BH, WFAI; Writing the Article: BH, WFAI Critical Review: BH, WFAI

Ethical Approval

This study was approved by Ethics Committee of Atatürk University (27.11.2021/244).