

## Research Article

# The Effect of the Sex on the Presence of Feline Panleukopenia

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Submitted: 17 January 2020

Accepted: 07 February 2020

Published: 15 February 2020

ISSN: 2379-948X

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## Keywords

- Feline panleukopenia
- Immune reactivity
- Sex
- Immune system
- Testosterone
- Estrogen

## Abstract

During the period 2014 - 2019, we collected data on 102 patients affected by feline panleukopenia from various veterinary clinics throughout the Slovak Republic. The patients were divided by sex and subsequently into two age groups. Of the 102 affected animals, 62 were male cats and 40 were female cats. This difference was statistically significant ( $p=0.029$ ). Of the 47 affected male cats, 32 were under 6 months of age and 15 were over 6 months of age. The difference between these age groups was statistically significant ( $p = 0.013$ ). Of the 26 affected female cats, 17 were under 6 months of age and 9 were over 6 months of age. This difference was not statistically significant ( $p=0.117$ ).

## ABBREVIATIONS

CPV-2: Canine Parvovirus 2; FPV: Feline Panleukopenia Virus; TLR: Toll-Like Receptor; RNA: Ribonucleic Acid; DNA: Deoxyribonucleic Acid; IL-10: Interleukin 10; CD4: Cluster of differentiation 4; CD8: Cluster of differentiation 8; NK- Natural Killer Cells; CCR5-C-C: Chemokine Receptor type 5; Th2: Th2 cells

## INTRODUCTION

Feline panleukopenia is a contagious, viral disease caused by the feline panleukopenia virus [1]. This virus causes enteritis and panleukopenia in cats and wild cats. Feline panleukopenia is most commonly found in cats younger than 12 months of age but it may also occur in aged unvaccinated animals. The increased incidence of feline panleukopenia correlates seasonally with an increase in the number of susceptible newborn kittens [2]. No data on the impact of sex on the incidence and course of feline panleukopenia are available in the literature. By comparison, several writers report in dogs that male dogs have a higher prevalence of parvovirus disease than female dogs. Unneutered male dogs over 6 months of age are up to twice as likely to develop parvovirus enteritis as female dogs [3]. The same case can be observed in humans. The available literature does not describe the effect of sex on increased susceptibility to viral diseases. However, in humans, it has been discovered that women tend to produce more antibodies than men [4,5]. This increased immune reactivity in women makes them generally more resistant to infections and less susceptible to viral infections [6,7]. The aim of this work is to determine the percentage of both sexes and neutered animals in a sample of patients affected by feline panleukopenia and to determine the mortality of both sexes and neutered animals for this infectious disease.

## MATERIAL AND METHODOLOGY

A total of 102 patients suffering from feline panleukopenia were included in the study. The diagnosis was confirmed by laboratory testing or by outpatient diagnosis (by SNAP assays) of the presence of FPV in the faeces. The patient data were collected from veterinary clinics from different regions of Slovakia for the period 2014 -2019. The patients were in the age from 3 weeks to 10 years, breed of European domestic cat. The patients were divided into two groups according the sex and subsequently into two age groups, one group up to the age of 6 months and the other from the age of 6 months or more. As not all clinics provided data on the age structure of the patients, only 73 patients were included in age groups. Subsequently, the percentage of both sexes in the patient sample was calculated and the age structure of the affected animals was also determined. Finally, the statistical significance of the data was assessed. Statistical significance of the obtained data was assessed by Chi Test at a significance level of  $p=0.05$ .

## RESULTS

Of the 102 animals affected, 62 were male and 40 were female, representing 60.78 % of males and 39.22 % of females. Thus, the difference between the affected male and female animals was 22 animals (21.56 %). This result was statistically significant. The calculated  $p$  reached a value below 0.05 ( $p=0,029$ ). Of the 47 affected males, 32 were under 6 months of age (68.08 %) and 15 were over 6 months of age (31.91 %). The difference between the two groups was also statistically significant as  $p$  was less than 0.05 ( $p = 0.013$ ). Of the 26 affected cats, 17 were under 6 months of age (65.38 %) and 9 were over 6 months of age (34.62 %). This difference was not statistically significant since  $p$  was greater than 0.05 ( $p=0,117$ ) (Table 1, 2).

**Table 1:** Number of affected males and females.

Sex	Number of affected animals	Percentage
Male	62	60,78%
Female	40	39,22%

**Table 2:** Number of affected animals under and over 6 months.

Sex	Male	Percentage	Number of affected animals
Male <6 months	32	68,08 %	47
Male >6 months	15	31,91%	
Female <6 months	17	65,38%	26
Female > 6 months	9	34,62%	

## DISCUSSION

Preserved pathogen-associated molecular patterns (PAMPs) of microorganisms can bind various receptors, for example TLRs. The expression of TLR receptors is various, depending on sex, TLR3, 7, and 9 are more widely studied in females and TLR2 and TLR4 in males, which may affect the strength of TLR-dependent immune responses. Macrophages from male mice produce higher TLR4- and TLR2-dependent Th1 responses in infection, whereas the immune response, which is regulated by estrogen through modulation of endosomal TLR and TLR8 expression, generally determines this hormonal balance in females [8-11]. TLR3, 7, and TLR9 recognize viral RNA or DNA, while TLR2 and TLR4 are known to bind cell wall proteins. For that reason, a different immune response may be associated with differences in the population of leukocytes between the sexes. Sex is also associated with immune responses to environmental factors such as infections and vaccination [12]. Women show a high post-viral immune reactivity [13]. Also, women generate a higher number of antibodies, which means vaccination results in higher antibody titres in women than men and provides effective protection [14]. Immunological sexual dimorphism has been described in both types of immunity, congenital and adoptive immunity [15]. In general, testosterone has an immunosuppressive effect, while estrogen has an immunostimulatory effect on the immune system. Estrogen regulates the immune response by impairing the negative selection of high affinity auto-reactive B cells, modulating B cell function and leading to a Th2 response [16,17]. Estrogen affects physiological functions via estrogen receptors that are expressed in the brain, epithelial cells, lymphoid tissue as well as leukocyte cell walls [18,19]. Estrogen also induces T cell homing by enhancing expression of CCR5, a homing marker [20]. Given the relative number of different leukocytes in males and females, overall the immune response is sex-specific and determines the pathogenicity of microorganisms. Described differences in the functioning of the immune system between the sexes, even in cats, can result in a higher susceptibility of unneutered male cats to feline parvovirus infection compared to unneutered female cats. A drawback of this study is a small sample of examined patients. On the contrary, an advantage of this study is that the patients came from different regions of Slovakia which means the sample is representative.

## CONCLUSION

The results of this paper show that male cats have a higher prevalence of feline panleukopenia than female cats. However, the sample of patients in our paper is small and it would be useful to confirm this result on a larger sample of patients in the future. Interestingly, while there was a statistically significant difference between the morbidity of male cats in the age group up to 6 months and over 6 months of age, there was no statistically significant difference between female cats in these groups. This may be due to the small number of the given groups. It would be interesting to observe the relationship between morbidity and mortality from feline panleukopenia and estrogen and testosterone concentrations in the blood serum of the examined sample of animals. On the basis of the foregoing claim that females tend to produce a higher titer of post-vaccination antibodies compared to males, for female cats, FPLV vaccination, associated with administration of exactly titrated amount of antibodies, would be more effective in post-exposure protection against feline panleukopenia instead of administration of specific immunoglobulins (lower dose). However, even this hypothesis would be a useful subject of a further study.

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#### Cite this article

Citarová A, Mojžišová J (2020) *The Effect of the Sex on the Presence of Feline Panleukopenia*. *J Vet Med Res* 7(2): 1182.