

Prevalence of feline leukemia virus infection and serum antibodies against feline immunodeficiency virus in unowned free-roaming cats

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Objective—To determine prevalence of FeLV infection and serum antibodies against feline immunodeficiency virus (FIV) in unowned free-roaming cats.

Design—Cross-sectional serologic survey.

Animals—733 unowned free-roaming cats in Raleigh, NC, and 1,143 unowned free-roaming cats in Gainesville, Fla.

Results—In Raleigh, overall prevalence of FeLV infection was 5.3%, and overall seroprevalence for FIV was 2.3%. In Gainesville, overall prevalence of FeLV infection was 3.7%, and overall seroprevalence for FIV was 4.3%. Overall, FeLV prevalence was 4.3%, and seroprevalence for FIV was 3.5%. Prevalence of FeLV infection was not significantly different between males (4.9%) and females (3.8%), although seroprevalence for FIV was significantly higher in male cats (6.3%) than in female cats (1.5%).

Conclusions and Clinical Relevance—Prevalence of FeLV infection and seroprevalence for FIV in unowned free-roaming cats in Raleigh and Gainesville are similar to prevalence rates reported for owned cats in the United States. Male cats are at increased risk for exposure to FIV, compared with female cats. (*J Am Vet Med Assoc* 2002;220:620–622)

Feline leukemia virus and feline immunodeficiency virus (FIV) are among the most common infectious diseases of cats. Feline leukemia virus and FIV belong to the retroviridae family, and both cause immunosuppression in cats. Feline leukemia virus was first described in 1964,¹ and FIV was first reported in 1987.² Both FeLV and FIV have worldwide distribution in domestic cats. The prevalence of FeLV infection ranges from 0 to 2% among pet cats in Sydney³ to 18% among sick cats in Italy.⁴ Seroprevalence for FIV ranges from 1% of low-risk cats in the United States and Canada⁵ to 44% of sick pet cats in Japan.⁶

The term free-roaming cats is used to describe homeless cats, including socialized strays and unso-

cialized feral cats. The number of free-roaming cats living in the United States has been estimated to be between 25 and 60 million.⁷ Free-roaming cats raise many public health issues, including the zoonotic concerns of rabies, bartonellosis, ascaridiasis, and toxoplasmosis.⁸ Free-roaming cats are also reservoirs for FeLV and FIV, which pose threats to the health of outdoor pet cats. The prevalence of FeLV and FIV in pet cats has been well described.^{5,9-12} However, to the authors' knowledge no studies of a large number of unowned free-roaming cats have been reported in the United States. The objective of this study was to determine the prevalence of FeLV infection and seroprevalence for FIV in unowned free-roaming cats in Raleigh, NC, and Gainesville, Fla.

Materials and Methods

Cats—All cats in the study were chosen from cats admitted to a trap-neuter-return program^a in Raleigh, NC, from January 1995 to September 1996 and in Gainesville, Fla, from August 1998 to April 2000. Feral and stray cats were trapped by local residents or caretakers and were brought to a free neutering clinic for free-roaming cats. Cats admitted to the trap-neuter-return program were anesthetized, neutered, vaccinated, and released to the location where they were trapped. The tip of the left ear was trimmed to identify the neutered cats. The program in Raleigh also tested all cats for FeLV antigen and anti-FIV antibody. Cats with positive test results were euthanatized, regardless of clinical condition. Cats in Gainesville were not routinely tested during the neutering program. Samples were collected specifically for this study from as many cats as possible without disrupting the operation of the clinic. No attempt was made to select cats on the basis of sex or body condition, and only cats judged to be adults on the basis of detection of permanent canine teeth were included in the study. Overall, 1,876 cats were included: 733 cats (347 males and 386 females) from the Raleigh program and 1,143 cats (555 males and 588 females) from the Gainesville program.

Sample collection—For the Raleigh program, blood was collected from the saphenous or jugular veins into tubes that contained EDTA. For the Gainesville program, serum was harvested from blood collected by jugular venipuncture into plain glass tubes.

Testing—In Raleigh, tests^b for FeLV antigen and anti-FIV antibodies were performed immediately. In Gainesville, serum was either tested immediately^b (n = 245) or frozen and shipped to a reference laboratory for batch testing^c (898). All testing was performed by use of ELISA methods.

Statistical analyses—All data were summarized by use of percentages. Percentages were compared for each analysis.

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The male-to-female ratio of the cats admitted for neutering to the Gainesville program was 40:60, compared with 49:51 for the cats sampled for the seroprevalence study. Therefore, the analyses for Gainesville were corrected to the 40:60 ratio representing the population from which the samples were collected. No corrections were required for the Raleigh program, because all cats admitted were tested. Coinfection analysis was performed by use of McNemar χ^2 for paired data, and the other comparisons were analyzed by use of the χ^2 test. A value of $P < 0.05$ was considered significant.

Results

In the Raleigh area, overall prevalence of FeLV infection and seroprevalence for FIV were 5.3 and 2.3%, respectively. Prevalence of FeLV infection in males (6.6%) and females (4.1%) was not significantly different ($P = 0.13$). Seroprevalence for FIV was significantly ($P < 0.001$) higher in males (4.3%) than in females (0.5%). Two male cats had positive results for FeLV and FIV (0.27% overall or 0.58% of males). The prevalence of positive results for either FeLV or FIV was 4.7% in females, 10.4% in males, and 7.4% overall. Males were significantly ($P = 0.003$) more likely to have positive results for at least 1 of the viruses than females were.

In the Gainesville area, the overall prevalence of FeLV and seroprevalence for FIV were 3.7 and 4.3%, respectively. Similar to the findings in Raleigh, there was no significant difference ($P = 0.9$) for FeLV infection rates between males (3.8%) and females (3.6%), and prevalence of seropositivity for FIV was significantly ($P < 0.001$) higher in males (7.6%) than in females (2.2%). Four male cats were infected with FeLV and seropositive for FIV (0.29% overall or 0.72% of males). Prevalence of either FeLV infection or seropositivity for FIV was 5.8% in females, 10.6% in males, and 7.8% overall. Males were significantly ($P = 0.003$) more likely to have positive results for at least 1 of the viruses than females were.

Overall ($n = 1,876$), prevalence of FeLV was 4.3%, and seroprevalence for FIV was 3.5%. Prevalence of FeLV infection was not significantly different ($P = 0.2$) between males (4.9%) and females (3.8%), but seroprevalence for FIV was significantly ($P < 0.001$) higher in male cats (6.3%) than in female cats (1.5%). Among the 1,876 cats, 3.7% (66/1,795) of the FeLV-negative cats were seropositive for FIV, whereas 7.4% (6/81) of the FeLV-positive cats were seropositive for FIV. Cats infected with FeLV were not significantly ($P = 0.09$) more likely to also be seropositive for FIV than were FeLV-negative cats. Prevalence of positive results for either FeLV or FIV was 5.4% in females, 10.5% in males, and 7.6% overall. Males were significantly ($P < 0.001$) more likely to have positive results for at least 1 of the viruses than females were.

Discussion

Feline leukemia virus and FIV have a worldwide distribution among pet cats. The epidemiologic features of FeLV and FIV infection have been described in more than 30,000 cats worldwide; most of the tested cats were owned pets, or their status was not defined. Only a few reports^{5,9-12} have together reported the prevalence of FeLV and FIV, and this was only in < 600

unowned free-roaming cats worldwide. Only 187 of these free-roaming cats were tested and reported in the United States and Canada.⁵ Prevalence of FeLV infection in free-roaming cats was 0% in South Vietnam¹¹ and 1% in Finland,¹⁰ and the seroprevalence of FIV ranged from 2% among low-risk free-roaming cats in the United States and Canada⁵ to 22% among free-roaming cats in South Vietnam.¹¹

In a US survey¹³ of FeLV infection and antibodies against FIV in 27,976 high-risk pet cats, 13% had positive results of tests for FeLV antigen, and 7% of the cats were seropositive for FIV antibody. In the same study, the prevalence of FeLV infection and seroprevalence for FIV in North Carolina ($n = 843$) were 20 and 8%, respectively. Prevalence of FeLV infection and seroprevalence for FIV in Gainesville ($n = 2,643$) were 13 and 8%, respectively.¹³ The high prevalence of infection in this national survey was most likely attributable to the selection of high-risk and ill cats. Another study¹⁴ in Seattle performed in pet cats (healthy and sick) reported the prevalence of FeLV infection and seroprevalence for FIV to be 7 and 4%, similar to the rates of FeLV and FIV reported in our study of unowned free-roaming cats.

Biting and territorial aggression are highly efficient modes of transmission for FIV.⁵ The natural territorial fighting behaviors of free-roaming sexually intact male cats can therefore predispose them to a higher rate of FIV infection. Several studies^{6,9,13-18} have confirmed this correlation between male sex and higher seroprevalence for FIV. In our study, male FIV seroprevalence was 4 times higher than female seroprevalence.

The major mode of transmission for FeLV is through saliva, milk, blood, and urine, both vertically and horizontally. Kittens are more susceptible to FeLV infection than adults are.¹⁹ The difference between males and females regarding FeLV infection is usually not as large as for FIV. In our study, no significant difference in prevalence of FeLV infection was found between the sexes.

In many reports, an outdoor lifestyle is reported as a predisposing factor for FeLV¹³ and FIV infection.^{5,9-12} One large serosurvey¹³ found that outdoor pet cats were 2.7 times as likely to have positive results for FeLV and 4.8 times as likely to be seropositive for FIV than indoor cats were. Because all the cats in our study were unowned free-roaming cats, it is reasonable to consider them as a high-risk population.

In our study, cats that were seropositive for FeLV were not more likely to be seropositive for FIV than were FeLV-negative cats. Previous reports on FeLV and FIV coinfections have reported conflicting findings. Although some studies^{3,6,17} have not found an association between the 2 infections, others have.^{13,15,16} Even if there is an association between the 2 infections, it is still unclear whether this would be attributable to the high-risk behavior and lifestyle of those cats or to compromise in immune function caused by 1 virus that enhanced the chance of infection by a second virus.

Results from our study indicate that the prevalence of FeLV infection and seroprevalence for FIV in unowned free-roaming cats are similar to infection rates reported for owned cats.

^aOperation Catnip in Raleigh, NC, and in Gainesville, Fla.

^bSNAP Combo, IDEXX Laboratories, Westbrook, Me.

^cPetChek, IDEXX Laboratories, Westbrook, Me.

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