Research Article

An Investigation of Stress Factor That Pose a Risk for Lower Urinary Tract Diseases in Cats

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Doi : 10.5281/zenodo.23404034

Abstract

This study was designed as a prospective, controlled, questionnaire-based case-control study to investigate stress-related risk factors for lower urinary tract diseases in cats. The study was conducted between 01.04.2026 and 01.09.2026 in veterinary clinics in Ankara, Turkey. Thirty-eight cats diagnosed with lower urinary tract disease were included as the patient group, and 31 healthy cats constituted the control group. The study was approved by the Kırıkkale University Local Ethics Committee for Animal Experiments (Decision No: 20, dated 25.03.2026). Data were collected using a 30-item questionnaire adapted from Cameron et al. (2004) and the MEMO protocol developed by Buffington et al. (2006), covering five main categories: demographic information, housing conditions, social environment, care practices, and owner profile. The questionnaire was administered through face-to-face interviews and via the Google Forms platform. No statistically significant differences were found between the patient and control groups regarding adoption age, current age, breed, sex and neuter status, body weight, number of cats in the household, feeding type, living area, daily routine regularity, and temperament characteristics. However, several noteworthy findings were obtained. A statistically significant difference was detected between groups in terms of litter box cleaning frequency ($p=0.022$; Cramer's $V=0.407$), with smart litter box use reported exclusively in the patient group. The presence of at least one clinical or behavioral problem in the past six months was significantly higher in the patient group ($p=0.045$; $OR=3.04$). Vocalization during urination ($p=0.019$) and hiding behavior ($p=0.034$) were reported at significantly higher rates in the patient group. Multiple correspondence analysis revealed that the two groups did not form completely distinct profiles; however, categories related to clinical symptom reporting and behavioral responses were positioned closer to the patient group.

These findings suggest that the evaluation of lower urinary tract diseases in cats should encompass not only clinical signs but also housing conditions, care practices, behavioral responses, and stress-related factors.

Keywords: Cat, feline lower urinary tract disease, FLUTD, feline idiopathic cystitis, stress factors, questionnaire study, risk factors

Introduction

Feline lower urinary tract diseases (FLUTD) refer to a group of multi-etiological conditions in cats that affect the lower urinary tract and present with variable clinical symptoms such as dysuria, hematuria, pollakiuria, stranguria, periuria (inappropriate urination), anorexia, and/or urethral obstruction (Gerber et al., 2005; Buffington et al., 2006; Forrester & Roudebush, 2007).

FLUTD is not a diagnosis; it is a clinical syndrome associated with multiple etiological causes. For this reason, proper management of the differential diagnosis process is of critical importance. The terms FUS (Feline Urological Syndrome) and feline lower urinary tract disease were introduced in the 1970s and 1980s to describe cats suffering from urinary tract disorders. Unfortunately, in veterinary medicine, these terms have come to imply a specific disease for some practitioners, whereas these conditions actually encompass the possibility of multiple different diagnoses. Over the years, new diagnoses and terms have been added to this syndrome; in the 1990s, new etiologies such as feline idiopathic cystitis and interstitial cystitis were identified and included. (Elliott et al., 2017).

The most common cause of lower urinary tract disease in cats is idiopathic cystitis. When healthy cats are exposed to stressful events, they initially release catecholamines but return to normal after the adaptation process. In cats with FIC, however, they exhibit a prolonged catecholamine response that lasts longer than normal, similar to anxiety disorders in humans. (Shaer, 2018). Studies conducted over the past twenty years have shown that FIC can develop rapidly when a susceptible individual/cat is exposed to a "stimulating environment." It has been determined that susceptible individuals possess more vulnerability factors (genetic, environmental) compared to resilience factors in response to environmental stimuli. This situation may increase the sensitivity of the central stress response system (SRS) to threats. The term "stimulating environment" refers to a setting where the animal's perception of threat exceeds its sense of control (i.e., where it experiences "stress"), and this can lead to chronic, sustained activation and heightened sensitivity of the SRS. (Elliott et al., 2017).

It is anticipated that the findings will lay the groundwork for developing evidence-based preventive recommendations in veterinary practice in Turkey and contribute to the creation of owner education programs. The study's contribution to science can be evaluated from several perspectives. First and foremost, it will generate a unique dataset by revealing the relationship between Turkey-specific dietary habits, housing conditions, and owner profiles and FLUTD. Furthermore, the systematic measurement of stress factors using a standardized method based on the questionnaire developed by Cameron and colleagues (2004) represents a methodological innovation; the findings obtained have the potential to contribute to the development of practical preventive recommendations for clinicians and to strengthen an evidence-based approach in veterinary practice in Turkey. This study also qualifies as one of the first prospective controlled studies in Turkey to address stress factors as the primary variable.

Material and Method

This study was designed as a prospective, controlled field study conducted between April 1, 2026, and September 1, 2026, at veterinary clinics in the province of Ankara that hold valid operating permits. A total of 69 cats were included in the study, and the animals were divided into two groups: the patient group (n=38) and the control group (n=31). The patient group consisted of cats diagnosed with lower urinary tract disease, while the control group consisted of healthy cats with clinical examination and laboratory findings within normal limits.

The patient group consisted of cats diagnosed with FLUTD by experienced veterinarians at the veterinary clinics where they were treated, based on clinical findings. The diagnosis was based on a detailed medical history and physical examination findings—dysuria, hematuria, pollakiuria, stranguria, or urethral obstruction—and all FLUTD subtypes, including feline idiopathic cystitis, urolithiasis, and urethral obstruction, were included in the study. The owner's consent to participate in the study was also among the inclusion criteria. Cases with concurrent systemic disease, signs of active infectious disease, a history of antibiotic or immunosuppressive medication use within 30 days prior to examination, cats younger than 6 months of age, and cases where the owner did not complete the questionnaire in full were excluded from the study.

All cats included in the study underwent clinical

examination and diagnostic evaluation according to a standard protocol. All animals were subjected to a systematic physical examination by experienced veterinarians; hydration status, bladder palpation findings, and a general systemic assessment were recorded.

Urine samples were collected preferably via cystocentesis; when this was not possible, they were obtained via free-flow or catheterization. Urine samples underwent strip analysis and microscopic sediment examination. In strip analysis, pH, specific gravity, protein, glucose, ketones, bilirubin, nitrite, leukocytes, and erythrocytes were evaluated; in microscopic examination, the presence of erythrocytes, leukocytes, epithelial cells, crystals, bacteria, and casts was investigated. Urine culture and antibiotic susceptibility testing were performed in cases deemed necessary.

Physicians performing the examination conducted B-mode abdominal ultrasonography on the group of cats deemed necessary. The Sonoscape E2V Digital Color Doppler Ultrasound System (Sonoscape Medical Corp., Shenzhen, China) was used for ultrasonographic evaluation. B-mode abdominal ultrasonography was performed on all cases; bladder wall thickness, intraluminal echogenicity, the presence of sand and stones within the lumen, and the urethral region along with other abdominal organs were systematically examined.

Results

When examining the ages at which cats were adopted, the highest rate in the patient group was observed among cats adopted between 2 and 5 months of age. 31.6% of the cats in the patient group were adopted during this period. In the control group, the adoption rate for the 2–5-month age group was similarly high, at 32.3%. In the control group, the adoption rate for cats adopted between 5 and 8 weeks of age appears to be higher than in the patient group. This category accounted for 35.5% in the control group, compared to 23.7% in the patient group. In contrast, the adoption rate for cats in the 5–12-month and 1-year-and-older age groups was higher in the patient group compared to the control group. Specifically, the adoption rate for cats 1 year and older was 18.4% in the patient group and 6.5% in the control group. However, no statistically significant difference was found between the patient and control groups regarding the age at adoption ($\chi^2 = 4.90$; df = 4; p = 0.298). Nevertheless, cats adopted at a later age were relatively more represented in the patient group.

In both groups, it was observed that cats were most frequently adopted from the street. The proportion of cats adopted from the street was 39.5% in the patient group and 38.7% in the control group. The rate of adoption from friends or acquaintances was higher in the patient group (28.9%) than in the control group (16.1%). In contrast, adoption via social media appears to be higher in the control group (19.4%) than in the patient group (5.3%). Adoption through pet shops is low in both groups. Overall, no statistically significant difference was found between the patient and control groups regarding the source of cat adoption (χ^2=4.193; df=4; p=0.380). This finding indicates that, in the current sample, the source of adoption is not a distinct variable that alone explains the difference between the patient and control groups.

When the overall distribution is evaluated, the proportion of middle-aged and older cats in the patient group appears to be relatively higher than in the control group. Specifically, cats aged 9 years and older accounted for 26.3% of the patient group and 19.4% of the control group. However, no statistically significant difference was found between the patient and control groups in terms of the current age distribution. This result indicates that, in the current sample, age is not a distinct factor that alone explains the distinction between the patient and control groups.

No statistically significant difference was found between the patient and control groups in terms of breed distribution (χ^2=5.134; df=7; p=0.644). The most common breed in both groups was the Turkish Angora. Turkish Angora cats accounted for 63.2% of the patient group and 67.7% of the control group. This finding indicates that Turkish Angora cats are predominant in the study population and are represented in similar proportions in the patient and control groups. The British Shorthair breed was present at a rate of 15.8% in the patient group and 16.1% in the control group, showing a very similar distribution between the two groups. The Scottish Fold breed accounted for 13.2% of the patient group and 9.7% of the control group. Other breeds were represented at low frequencies and were observed in limited numbers within the total sample.

Table 1. Relationship with the outdoor

Frequency of visitors	Patient n (%)	Control n (%)	Total n (%)
Occasionally	15 (39.5)	17 (54.8)	32 (46.4)
Rarely	19 (50.0)	8 (25.8)	27 (39.1)
Frequently	3 (7.9)	6 (19.4)	9 (13.0)
Constantly	1 (2.6)	0 (0.0)	1 (1.4)
Total	**38 (100.0)**	**31 (100.0)**	**69 (100.0)**

Table 2. Routine Acitvation

Daily routine order	Patient n (%)	Control n (%)	Total n (%)
Yes, quite regular	19 (50.0)	15 (48.4)	34 (49.3)
No, irregular	1 (2.6)	2 (6.5)	3 (4.3)
Partially regular	18 (47.4)	14 (45.2)	32 (46.4)
Total	**38 (100.0)**	**31 (100.0)**	**69 (100.0)**

Discussion

In this study, cats diagnosed with lower urinary tract disease were compared with a healthy control group in terms of demographic characteristics, care habits, environmental factors, and behavioral traits. The findings revealed that while the patient and control groups largely exhibited similar profiles, significant differences were observed between the groups in variables such as litter box cleaning frequency, history of problems in the past six months, meowing while urinating, and hiding behavior. In this section, the findings were discussed within the framework of relevant literature; the study's strengths and weaknesses, as well as its clinical significance, were evaluated.

No statistically significant difference was found between the groups in terms of current weight distribution (Figure 3.7 and Table 3.7). The predominance of the 3–5 kg weight range in the patient group (50.0%) and the higher representation of cats weighing over 7 kg in the patient group compared to the control group (7.9% vs. 3.2%) align with the obesity-FLUTD association (Figure 3.7 and Table 3.7). The literature reports a significant increase in the risk of FLUTD in obese cats; this is emphasized as being associated with a sedentary lifestyle, reduced frequency of bladder emptying, and chronic inflammation originating from adipose tissue (Cameron et al., 2004; He et al., 2022). However, in the current study, the fact that weight information is based on owner reports and that weight was asked in a categorical manner limits the sensitivity of this variable. These results are consistent with the literature.

Based on the data from this study, it was observed that the vast majority of cats in both groups did not live with another animal species, and no significant difference was found (Figure 3.9 and Table 3.9). The rate of cohabitation with dogs was found to be higher in the control group compared to the patient group. This finding suggests that the presence of another animal species does not constitute a significant risk for FLUTD. However, it should not be forgotten that individual cat personality and adaptability may play a decisive role in this relationship (Buffington, 2011).

This study compared cats diagnosed with lower urinary tract disease with a healthy control group in terms of demographic characteristics, care practices, environmental factors, clinical signs, and behavioral characteristics. The findings can be summarized as follows:

However, notable differences were observed between the groups in certain variables. A statistically significant difference was found between the groups regarding the frequency of litter box cleaning; in particular, the fact that the use of smart litter boxes was reported only in the patient group and the differences in the distribution of cleaning frequency categories were noteworthy. The prevalence of experiencing at least one clinical or behavioral problem in the past six months was found to be significantly higher in the patient group compared to the control group; the likelihood of being in the patient group was approximately three times higher among cats reporting problems. When symptoms reported in the past six months were evaluated individually, meowing while urinating and hiding behavior were found to be

statistically significantly higher in the patient group. Symptoms such as changes in urine color and behavioral changes were observed at a higher rate in the patient group but did not reach the threshold for statistical significance.

Given the sample size and methodological limitations of this study, the findings should be interpreted not as causal relationships but as potential clinical and behavioral trends. To more comprehensively establish the relationship between FLUTD and stress factors in the feline population in Turkey, it is recommended that prospective studies be conducted with larger sample sizes, involving multiple centers, and based on standardized diagnostic protocols.

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