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ORIGINAL ARTICLE

STUDY OF FELINE LOWER URINARY TRACT DISEASE IN BLIDA, NORTH OF ALGERIA: CLINICAL AND EPIDEMIOLOGIC FEATURES

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Ethical considerations: When reporting experiments on animals Observation of the ARRIVE guidelines 2.0: Updated guidelines for reporting animal research, published in July 14, 2020 (https://doi.org/10.1371/journal.pbio.3000410), is applied. The authors ensure that all procedures were performed in compliance with the guidelines for animal care of their institutions or with national/international guidelines.

ABSTRACT

Feline lower urinary tract disease (FLUTD) is a common problem in cats. The objectives of the present study were to determine the prevalence, clinical signs, causes and the risk factors for FLUTD. From 1514 cats that presented to private veterinary clinic located in the region of Blida, 95 cats (6.27 %) were diagnosed with FLUTD and were included in the study. For each animal, potential risk data were obtained from medical records and cat owner interviews. FLUTD diagnoses were based on physical examinations, urinalyses, ultrasound examinations, and bacterial cultures. The most frequent cause of FLUTD was feline idiopathic cystitis (FIC) (43.15 %), followed by urolithiasis (26.32 %), urinary tract infection (UTI) (21.05 %), urethral plugs (8.42 %) and neoplasia (1.05 %). The most common clinical signs of FLUTD were dysuria (76.84 %), hematuria (60 %), pollakiuria (45.26 %), anuria/oliguria (42.10 %), depression (36.84 %), periuria (34.73 %). In the UTI, the most common bacterial isolate was *Escherichia coli* and the mineral compositions in the analyzed uroliths were mostly struvite crystals. The sex, castration status, breed, living environment, type of food were found to be significantly associated with FLUTD. Male cats ($P < 0.0001$), spayed/neutered cats ($P = 0.00014$), European shorthair breed ($P < 0.0001$), the indoor living cats ($P < 0.00001$), cats having dry food ($P < 0.00001$) were most susceptible to FLUTD. Cats aged over 5 years were the most affected, but no significant difference was found in age ($P = 0.158$). The prevalence of FLUTD was not correlated with the presence of other cats in the household ($P = 0.051$). The present study revealed a non-negligible prevalence of FLUTD in the north of Algeria. Appropriate recommendations need to be introduced to control the disease.

Key words: clinical signs; feline lower urinary tract disease; prevalence; risk factors

INTRODUCTION

FLUTD is a common disease in cats [9]. It is a syndrome that affects the reproductive tract, urinary bladder or urethra [18]. FLUTD is a broad terminology that involves many disorders, including feline idiopathic cystitis (FIC), urethral obstructions, urolithiasis, urinary tract neoplasia, and urinary tract infection (UTI). The most frequent type of FLUTD is FIC. While neoplasias are categorized as being one of the less common causes of FLUTD [5, 8, 9, 12, 18, 20]. Common clinical manifestations of the disease include dysuria, hematuria, stranguria, pollakiuria and periuria [5,8]. The diagnosis is based on the above mentioned symptoms alone, regardless of their cause. Accordingly, urine analyses, radiography and abdominal ultrasonography are used [5] in order to support differential diagnosis of urinary tract diseases [12]. FIC is a diagnosis of exclusion and is generally diagnosed by eliminating other urinary tract disorders such as urolithiasis, bacterial infection, anatomical defects or tumours [12]. The risk factors for FLUTD differ across countries due to geography, season, diets and cats' lifestyle [5]. FLUTD is rare in females and common in male cats, due to the anatomy of the penile urethra [2]. Certain common breeds were reported to experience lower urinary tract disease more frequently, such as Persian, Himalayan, and Russian Blue. Some of these breeds are considered to have a predisposing factor to the formation of uroliths so that urinary tract obstruction occurs. Abyssinian cats were commonly predisposed to bacterial UTI [11]. Castration and spaying are considered risk factors associated with the inhibition of urethral growth, induction of weight gain, and a sedentary lifestyle [16]. Indoor care setting [5], commercial dry food and excess body weight [18] were reported to increase the risk of FLUTD. In Algeria, only one study on prevalence and risk factors of FULTD has been published [19]. The current lack of information about risk factors for FULTD in Algeria cats and the usefulness of this knowledge for designing and implementing FULTD control motivated this study. Therefore, the objectives of the present study were to determine the prevalence, clinical signs, and risk factors for FLUTD in cats in Blida, north of Algeria.

MATERIALS AND METHODS

1. Animal and data collection

A total number of 1514 cats presented to private veterinary clinic located in the region of Blida between June 2023 and June 2024 were reviewed, and 95 cats diagnosed with FLUTD were included in the study. Only patients displaying urinary tract symptoms (hematuria, pollakiuria, periuria, obstruction and pain) were included. Owners reported crying out during urination, an abnormally difficult walk, or startling upon contact with the abdomen as signs of pain in the cats. Demographic data and risk factors were collected through face-to-face questionnaires with the cats' owners. The following data were acquired: the animal's age, breed, sex, body weight, type of food, household and lifestyle, the animal's reproductive status, presence of animals in the household. The types of food included dry and wet food. The lifestyles were indoor housing or outdoor housing. Also, the owners provided information about the duration and persistence of symptoms, urination frequency, and possible stressors.

2. Procedures (methods)

Detailed clinical examination of each patient was carried out. Visual inspection was applied while respiration, pulse rates and rectal temperature were carefully recorded. The studied patients were categorized into FIC, urolithiasis, urethral plug (UP), UTI, and neoplasia according to their respective diagnoses. UTI was diagnosed when significant bacterial growth was evident in the urine culture. An urethral plug was diagnosed when the urethra was obstructed by plug. An urolith was diagnosed using abdominal radiography and ultrasonography. Neoplasia was diagnosed ultrasonographically by the identification of a mass lesion. FIC was diagnosed by eliminating the other specific possibilities. FLUTD diagnostic methods in this study are based on the parameters used by Dorsch et al. [5] (Table 1). Determination of the obstructive and non obstructive form was based on abdominal palpation of the urinary bladder and the evaluation of urethral patency during catheterisation. The urine samples from the 95 cats displaying urinary tract symptoms were also tested by cytological and microbiological culturing. 10 ml of urine samples were centrifuged for 10 minutes at 1500 rpm and the sediment was examined for the presence of crystal-like formations. Microbiological tests were done by catheteri-

Table 1. Definition of diagnoses in cats with clinical signs of FLUTD [5]

Diagnosis	Definition	Exclusion
Feline idiopathic cystitis	Diagnosis of exclusion	- Urocystoliths identified on abdominal radiographs or ultrasound - Positive urine culture with significant bacterial growth (≥ 10^3 CFU. ml^{-1}) - Evidence of neoplasia on abdominal ultrasound - Struvite crystalluria ("numerous" or "too numerous to count" or +++ on examination of the urine sediment) without obstruction
Bacterial urinary tract infection	Significant bacterial growth (≥ 10^3 CFU.ml^{-1}) in urine samples obtained per cystocentesis or catheterization at the time of presentation	- Urocystoliths identified on abdominal radiographs or ultrasound - Evidence of neoplasia on abdominal ultrasound
Urethral plug	Detection of a urethral plug on catheterization and/or numerous struvite crystals in urine sediment and urethral obstruction	- Urocystoliths or urethroliths identified on abdominal radiographs or ultrasound - Evidence of neoplasia on abdominal ultrasound - Significant bacterial growth (≥ 10^3 CFU.ml^{-1}) in urine samples obtained per cystocentesis or catheterization at the time of presentation
Uroliths	Uroliths identified on radiographs and/or ultrasound	- Evidence of neoplasia on abdominal ultrasound
Neoplasia	Ultrasonographically identified mass lesion (with or without a definitive histologic diagnosis)	- Urocystoliths identified on abdominal radiographs or ultrasound
Miscellaneous	Struvite crystalluria (numerous crystals on examination of the urine sediment) without obstruction Neurologic disorders associated with FLUTD symptoms	- Urocystoliths identified on abdominal radiographs or ultrasound - Evidence of neoplasia on abdominal ultrasound

zation and grown on mannitol salt agar, MacConkey agar, and blood agar (containing 5 % sheep blood). The cultures were incubated at 37 ^{o}C for 24 – 48 h [6].

3. Statistical analysis

Data analysis was performed using Microsoft Excel 2010 and Statistical Data for Social Science (SPSS) 26© IBM Copyright, IBM Corporation and its licensors 1989.2019 IBM, USA. Results were expressed as percentages and 95 % confidence intervals (CIs) were calculated. Univariate analysis was performed to assess each independent variable for its unadjusted association with disease. The chi-square test of homogeneity and independence as well as the Mann-Whitney U test and the Kruskal-Wallis test were performed. The statistical significance level used for this study was $P < 0.05$.

RESULTS

From 1514 cats inspected, 95 (6.27 %), 95 % CI = [5.1 % – 7.5 %] patients were diagnosed with FLUTD. The most frequent diagnosis was FIC in 41 cats (43.15 %), followed by urolithiasis in 25 cats (26.32 %), urinary tract infection (UTI) in 20 cats (21.05 %), urethral plugs in 8 (8.42 %) and neoplasia in one cat (1.05 %). A very high significant difference ($P < 0.00001$) was recorded between the number of cases found in each disease. The clinical signs associated with different groups of FLUTD diagnostic groups were documented in Table 2. Dysuria 73 (76.84 %), hematuria 57 (60 %), pollakiuria 43 (45.26 %), anuria/oliguria 40 (42.10 %), depression 35 (36.84 %), periuria 33 (34.73 %), dark urine 22 (23.15 %), inappetence 18 (18.94 %), fever 5 (5.26 %), polyuria 4 (4.21 %), pyuria 2 (2.10 %), vomiting 1 (1.05 %) were the common signs of FLUTD.

Obstructive FLUTD was diagnosed in 34 cats (35.78 %), all cats with urolithiasis, urethral plugs and neoplasia were classified as obstructed, while non case of obstructive FLUTD was diagnosed in cats with FIC and UTI. The clinical signs of obstructive and non-obstructive FLUTD are shown in Table 3.

Bacterial growth in urine cultures was observed in 20 cats. *Escherichia coli* was isolated from 10 cats, *Staphylococcus* spp. from 4 cats, *Staphylococcus saprophyticus* from 3 cats, mixed infection with *Escherichia coli* and *Pseudomonas* from 2 cats, and polymicrobial culture was found in one cat. The crystal-like formations was found in 25 cats including struvite crystals (9 cats), urate crystals (7 cats), while the other cases showed the presence of calci-

Table 2. Clinical signs of all cats with FLUTD and cats diagnosed with the five different diseases [n (%) of cats]

	All cats	FIC	Urolithiasis	UTI	UP	Neoplasia	P-value
Total	95(100)	41 (43.15)	25(26.04)	20 (21.05)	8 (8.42)	1(1.05)	<0.00001
Dysuria	73(76.84)	28(68.29)	22(88)	16(80)	6(75)	1(100)	<0.00001
Macroscopic Hematuria	57(60)	24(58.53)	13(52)	14(70)	5(62.5)	1(100)	<0.00001
Pollakiuria	43(45.26)	16(39.02)	13(48)	12(60)	2(25)	0	0.0001
Anuria/oliguria	40(42.10)	19(46.34)	11(44)	4(20)	5(62.5)	1(100)	<0.00001
Depression	35(36.84)	15(36.58)	11(44)	5(25)	4(50)	0	0.0004
Periuria	33(34.73)	13(31.70)	9(36)	5(25)	5(62.5)	1(100)	0.0134
Dark urine	22(23.15)	11(26.83)	8(32)	2(10)	1(12.5)	0(0)	--
Inappetence	18(18.94)	9(21.95)	5(20)	2(10)	2(25)	0	--
Fever	5(5.26)	4(9.75)	0	1(5)	0	0	--
Polyuria	4(4.21)	2(4.87)	1(4)	1(5)	0	0	--
Pyuria	2(2.10)	0	1(4)	1(5)	0	0	--
Vomiting	1(1.05)	1	0	0	0	0	--
P-value	<0.0001	<0.0001	<0.0001	<0.0001	-	-	

Table 3. Comparison of the frequency of the reported clinical signs in the cats with the non-obstructive and obstructive form of FLUTD

Group	Non-obstructive form n (%)	Obstructive form n (%)	P-value
Number of cats	61(64.21)	34(35.78)	0.0056
Dysuria	44(72.13)	29(85.29)	0.144
Macroscopic Haematuria	38(62.29)	19(55.88)	0.540
Pollakiuria	28(45.90)	15(44.11)	0.867
Anuria/oliguria	23(37.70)	17(50)	0.244
Depression	20(32.78)	15(44.11)	0.272
Periuria	18(29.5)	15(44.11)	0.151
Dark urine	13(21.31)	9(26.47)	0.393
Inappetence	5(11.9)	7(20.58)	0.155
Fever	5(8.19)	0	0.216
Polyuria	3(4.91)	1(2.94)	----
Pyuria	1(1.63)	1 (2.94)	----
Vomiting	1(1.63)	0	----

um oxalate crystals (3 cats), uric acid crystals (3 cats) and phosphate crystals (3 cats).

Demographic data and risk factors diagnosed with FLUTD are presented in Tables 4 and 5. Using the chi-square test, sex, breed, castration status, living environment, the type of food were found to be significantly associated with FLUTD. Male cats were more common than female cats in all types of FLUTD ($P < 0.0001$), including FIC, UTI, UP, urolithiasis, and neoplasia. The average age of cats with FLUTD was 5.13 ± 3.85 years. Cats aged over 5 years were more affected than those aged between 8 months and 2 years, while the youngest animals from 8 months to 2 years were less affected, no significant difference was found between the 3 classes ($P = 0.158$). However, in UTI and UP, the cats aged from 8 months to 2 years were the most affected, European shorthair breed was more likely to have FLUTD, followed by Persian cats, Siamese cats and Angora cats ($P < 0.0001$). Urolithiasis and neoplasia were more diagnosed in Persian cats. With the exception of neoplasia, spayed/neutered cats were more susceptible to FLUTD than intact cats ($P = 0.00014$). The mean body weight of the cats with FLUTD was $4.40 \text{ kg} \pm 0.89 \text{ kg}$, no significant difference was found between the different diseases (FIC, urolithiasis, UTI, UP and neoplasia). Among all patients diagnosed with FLUTD, 71 (74.73 %) were indoor cats, the prevalence of FLUTD was highly correlated with the indoor living mode of cats ($P < 0.00001$). Almost all cats (98.94 %) with FLUTD were fed only dry food

Table 4. Analyzes of cats affected by FLUTD according to risk factors [n (%) of cats]

Group	All cats	P-value
Number of cats	95	
Sex		
Male	68(71.57)	<0.0001
Female	27(28.42)	
Age		
[8 months- 2 years]	25(26.31)	
[3 -5 years]	30(31.57)	0.158
>5years	40(42.10)	
Breed		
European	46(48.42)	
Persian	25(26.31)	<0.0001
Angora	10(10.52)	
Siamese	14(14.73)	
Sexual state		
Spayed/ Castrated	66(69.47)	0.00014
Intact	29(30.52)	
Weight (kg) Mean ± SD	4.40 ± 0.89	
Living environment		
Indoor	71(74.73)	<0.00001
Outdoor	24(25.26)	
Food		
Dry	94(98.94)	<0.00001
Wet	1(1.05)	
Presence of other cat(s)		
No	38(40)	0.051
Yes	57(60)	

and only one cat diagnosed with UP was fed a wet food, a highly significant difference was recorded between the two types of food (P < 0.00001). The prevalence of FLUTD was not correlated with the presence of other cats in the household (P = 0.051).

DISCUSSION

The prevalence of FLUTD in this study (6.27 %) was almost similar to 8 % reported for the United States and Canada from 1980 to 1997 [11], but higher than the 2.24 % and 2.29 % reported by Piyarungsri et al. [18] and Kochan and Simsek [8], respectively. These different results may be due to differences in the geographic area, diet, popular breeds of cats in each country and duration of sample collection [18]. In the present study, FIC was the most frequent diagnosis (43.15 %). Similarly, relevant studies from different countries reported FIC as the most prevalent FLUTD with a reported prevalence ranging from 51 % to 60 % [5, 8, 9, 12, 18, 20]. Many theories about the causes of FIC have been proposed, but the specific etiological factor(s) are still unknown [20]. According to Buffington [3], FIC is a result of the

Table 5. Analyzes of cats affected with FIC, urolithiasis, UTI and UP according to risk factors [n (%) of cats]

Group	FIC	Urolithiasis	UTI	UP	Neoplasia	P-value
Number of cats	41	25	20	8	1	<0.00001
Sex						
Male	27(65.85)	20(80)	15(75)	5(62.5)	1(100)	<0.00001
Female	14(34.14)	5(20)	5(25)	3(37.5)	0	<0.001
Age						
[8 months - 2 years]	7(17.07)	6(24)	8(40)	4(50)	0	0.091
[3 - 5 years]	16(39.02)	7(28)	5(25)	1(20)	1(100)	<0.0001
> 5 years	18(43.9)	12(48)	7(35)	3(30)	0	<0.0001
Mean ± SD years	5.12 ± 2.75	5.09 ± 3.1	5.88 ± 5.83	5.58 ± 4.6	5	P = 0.804
Breed						
European	24(58.53)	7(28)	10(50)	5(62.5)	0	<0.00001
Persian	8(19.51)	8(32)	6(30)	2(25)	1(100)	0.066
Angora	6(14.63)	4(16)	0	0	0	----
Siamese	3(7.31)	6(14)	4(20)	1(12.5)	0	----
Sexual state						
Spayed/ Castrated	32(78.04)	15(61.11)	13(65)	6 (75)	0	<0.00001
Intact	9(21.95)	10(38.88)	7(35)	2(25)	1(100)	0.0213
Weight (kg) Mean ± SD	4.43 ± 0.79	4.43 ± 0.74	4.48 ± 1.08	4.10 ± 1.14	3.4	P = 0.851
Living environment						
Indoor	34(82.92)	17(68)	15(75)	4(50)	1(100)	<0.00001
Outdoor	7(17.07)	8(32)	5(25)	4(50)	0	----
Food						
Dry	41(100)	25(100)	20(100)	7(87.5)	1(100)	<0.00001
Wet	0	0	0	1(13.5)	0	----
Presence of other cat(s)						
No	10(24.39)	13(52)	12(60)	2(25)	1(100)	0.0019
Yes	31(75.6)	12(48)	8(40)	6(75)	0	<0.0001

inadequate reaction to variable stressors due to the chronic activation of the central threat response system (CTRS). It is believed, that the CTRS may be sensitized by threatening events that can occur early in life, even before birth, when the CTRS is the most plastic and vulnerable [4]. The second most common cause of FLUTD in our study was urolithiasis (26.32 %). Similar results were reported by Kovarikova et al. [9], Piyarungsri et al. [18], Kochan and Simsek [8]. However, these findings contradict the previous report of Ayoub et al. [1], which indicate urolithiasis is the most frequent cause of FLUTD, followed by FIC. The dietary regimens of the patients included in the study, especially dry food, may account for the high incidence of urolithiasis. The formation of crystal was observed only in urolithiasis cases. The majority of crystal-like formations in our study were struvite crystals of which commercial feed is a main cause. Same results were recorded by Tariq et al. [22], Lew – Kojrys et al. [22] and Nururrozi et al. [16]. Ayoub et al. [1] reported a decrease in the struvite-containing uroliths and an increase in the calcium oxalate-containing uroliths. The urinary tract infection (UTI) reported in the present study (21.05 %) is in line with findings reported by Nururrozi et al. [8], Kraijer et al. [10] and Dorsch et al. [5] who reported rates of 25.3 %, 22.2 % and 18.9 %, respectively. The percentage of UTI cases from this study was higher than 14.2 % reported by Ayoub et al. [21], 11.8 % recorded by Sævik et al. [20], and 8 % reported in Poland by Lew – Kojrys et al. [12]. The different results may be caused by the different methodology with various inclusion criteria. Escherichia coli were the most common isolates, similar finding has been reported by Sævik et al. [20], Lew – Kojrys et al. [12] and Ayoub et al. [1]. However, some reports showed an increasing trend in the prevalence of Staphylococcus species [15, 23]. Most human uropathogenic bacteria originate from the gut [14]. This event was supported in this study as the leading bacteria, Escherichia coli, are also part of the normal feline gut flora [15]. UP was identified as the cause of FLUTD in 8.42 % of the cats included in the present study. The rate of UP was reported by Nururrozi et al. [16] as 4.9 %, Gerber et al. [7] as 10 %, Dorsh et al. [5] as 10.3 %, Kochan and Simsek [8] as 13 %, by Sævik et al. [20] as 21.0 %. In contrast to uroliths, urethral plugs consist of large quantities of organic matter and varying amounts of minerals, mainly struvite [17]. The percentage of neoplasia was 1.05 %, making it the least prevalent cause of FLUTD. Previous findings recorded very low rates of neoplasia ranging between 0.4 % and 3.6 % [1,8,16]. Kochan and Simsek [8] reported that the most common clinical manifestations in cats with FLUTD were pain (100 %), stranguria (81.57 %), pollakiuria (73.68 %), obstruction (60.52 %), hematuria (50.0 %) and periuria (28.9 %). Lew – Kojrys et al. [12] recorded that the clinical signs associated with the disease were stranguria (81.3 %), pollakiuria (71.7 %), obstruction (59.5 %), hematuria (49.9 %) and periuria (25.9 %). Dorsch et al. [5] reported that the the most common clinical signs were stranguria (54.0 %), obstruction and hematuria and their incidence rates were 54.0 %, 52.6 % and 42.4 %, respectively. The clinical signs varied by study and depended on the lifestyle of the cats, including indoor or outdoor husbandry. An owner's ability to observe clinical signs is affected by many factors, including outdoor access, the number of cats and the owner's work schedule. Furthermore, only the prominent clinical signs of FLUTD, such as dysuria or hematuria, can be easily detected in outdoor cats [18].

Most of the cats diagnosed with FLUTD in this study were males, which is similar to the findings by Nururrozi et al. [16], Mazda et al. [15], Ayoub et al. [1]. This might be attributed to the long and narrow urethra in males [20]. In another hand, Kovarikova et al. [9] noted that the urethral plugs were only found in the males while the highest proportion of females was found in the UTI subgroup, this might be explained by the fact that in male cats, where the risk of obstructive uropathy is higher, the treatment is more often required, while in females, clinical symptoms may be subtle and overlooked [9]. The most common breed affected regardless of the cause of FLUTD were European shorthair, which are the most common cats in Algeria. Kovarikova et al. [9] reported that Domestic Shorthair cats, British Shorthair cats, Persian cats and Maine Coon cats had an increased risk of developing FLUTD. In our study, urolithiasis was more often diagnosed in Persian cats, Ayoub et al. [1] noted that Persian cats were the most affected breed with FLUTD and this Persian breed represented the highest percentage of obstructive urolithiasis. According to Nururrozi et al. [16], the oxalate crystals and stones are more often found in some breeds like Himalayan, Persian, Burmese, and Russian blue cats and that genetic factors may contribute to an increased

risk of calcium oxalate urolith formation [16]. However, S æ v i k et al. [20] found no association between cat breed and FLUTD. The variability in the results is probably due to the popularity of particular cat breeds at different times. This variability probably shows that in areas where pedigree cats are more common, they become affected [18]. The current study showed that the most cats with FLUTD were spayed or neutered cats. P i y a r u n g s r i et al. [18] and R e m i c h i et al. [19] revealed that neutering was associated with an increased risk for FLUTD. In contrast, A y o u b et al. [1] reported that most cats with FLUTD were intact. B o r g e s et al. [2] reported that castration affects the density of the elastic and collagen fibers in the periurethral tissues; this decreases the compliance of the periurethral region. Also, most castrated male cats were less active, leading to weight gain, a common risk factor for FLUTD [18]. Almost all cats (98.94 %) with FLUTD were fed only dry food. This finding agreed with previous studies that found that dry food was associated with an increased risk for FLUTD [1,18]. However, B o r g e s et al. [2] reported that there was no significant difference in the diet between cats with FLUTD and clinically normal cats. L u n d and E g g e r t s d ó t t i r [13] considered the dry food as an important risk factor for FLUTD and urolithiasis formation as it influences urinary pH. Also, S k o c h et al. [21] recorded that the dried industrialized food, including cereals, tends to alkalinize the urine and predisposes to the formation of struvite crystals. A higher proportion of the patients were managed completely indoors (74.73 %). Same results were found by D o r s c h et al. [5], L e w – K o j r y s et al. [12], K o v a r i k o v a et al. [9], M a z d a et al. [15]. An inappropriate environment like being more fearful or nervous and having conflicts with other cats in the same household can be risk factors and cause FLUTD among cats. From K o v a r i k o v a et al. [9], the indoor environment with no access to the outside associated with using a litter box, lower activity level, lower hunting behaviour are other risk factors suggesting that an indoor environment frequently does not meet the feline's natural needs and it acts as a stressor.

CONCLUSION

This study highlights the importance of managing social stress in cats to prevent these diseases. The results obtained provide practical recommendations to improve the management of FLUTD, taking into account the specification and practical constraints of each case.

DATA AVAILABILITY STATEMENT

The raw data of this article will be made available by the authors, without undue reservation.

ETHICAL STATEMENT

There is no ethical approval needed.

CONFLICT OF INTEREST

There is no conflict of interest.

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AUTHORS CONTRIBUTIONS

Author Dr. Asma Dahmani was responsible for the experimental work and the writing of the article. Author Ms. Safia Zenia was responsible for the statistical analysis.

GENERATIVE AI STATEMENT

The authors declare that no Gen AI was used in the creation of this manuscript.

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