OCCURRENCE OF FELINE LOWER URINARY TRACT DISEASE (FLUTD) CASES IN KOTA BHARU DISTRICT, KELANTAN, WITHIN THE PERIOD OF JUNE UNTIL OCTOBER 2024

By

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ABSTRACT

Feline Lower Urinary Tract Disease (FLUTD) is a common and often recurrent condition affecting cats. Various studies and research have been conducted on FLUTD cases worldwide and in Malaysia. Yet, there is no evidence of the prevalence and recurrence rates in the Kota Bharu district. Thus, this study aims to investigate the occurrence and characteristics of FLUTD cases within the Kota Bharu district, Kelantan, from June to October 2024. The records of 3373 feline cases were presented to private clinic in Kota Bharu were reviewed to investigate the FLUTD incidence. Results showed 23 FLUTD cases were recorded within five months, and the highest incidence of FLUTD cases was recorded in August (34.78 %). Tom cats had 22 cases of FLUTD (95.65%), domestic shorthairs breed was predisposed to FLUTD, 17 cases (73.91%) and 20 cases of FLUTD (86.96%) were recorded in young adults (1-6 y/o). Most cats suffered from FLUTD when fed dry feed; 14 cases (60.87%) and 19 cats experienced stranguria (82.61%) and hematuria, 11 cases (47.83%). FIC was diagnosed in 14 cases (60.87%), followed by urolithiasis and UTI, 8 cases, respectively (34.78%). Recurrent rates were determined at 30.43% for cats brought to the clinic. The study found a notable prevalence of FLUTD among certain demographic and lifestyle categories, emphasizing the need for targeted management and preventive strategies.

Keywords: FLUTD, clinical presentations, incidence, and preventative

KEJADIAN KES PENYAKIT SALURAN KENCING BAWAH FELINE (FLUTD) DI DAERAH KOTA BHARU, KELANTAN DALAM TEMPOH JUN SEHINGGA OKTOBER 2024

ABSTRAK

Penyakit Saluran Kencing Bawah Kucing (FLUTD) adalah keadaan biasa dan sering berulang yang menjejaskan kucing. Pelbagai kajian dan penyelidikan telah dijalankan ke atas kes FLUTD di seluruh dunia dan di Malaysia. Namun, tiada bukti mengenai kelaziman dan kadar berulang di daerah Kota Bharu. Justeru, kajian ini bertujuan untuk menyiasat kejadian dan ciri-ciri kes FLUTD dalam daerah Kota Bharu, Kelantan, dari Jun hingga Oktober 2024. Rekod 3373 kes kucing telah dibentangkan ke Pusat Perubatan Haiwan Swasta di Kota Bharu dan disemak untuk menyiasat kejadian FLUTD. Keputusan menunjukkan sejumlah 23 kes FLUTD telah direkodkan dalam tempoh lima bulan dan insiden tertinggi kes FLUTD direkodkan pada Ogos (34.78%). Kucing jantan mempunyai 22 kes FLUTD (95.65%), baka bulu pendek domestik terdedah kepada FLUTD, 17 kes (73.91%) dan 20 kes FLUTD (86.96%) direkodkan pada kucing dewasa muda (1-6 tahun). Kebanyakan kucing mengalami FLUTD yang diberi makanan jenis kering, 14 kes (60.87%) dan 19 kucing mengalami stranguria (82.61% dan hematuria, 11 kes (47.83%). FIC didiagnosis dalam 14 kes (60.87%), diikuti dengan urolithiasis dan UTI, 8 kes, masing-masing (34.78%) dan kadar berulang telah ditentukan pada 30.43% untuk kucing yang dibawa ke klinik. Kajian mendapati kelaziman FLUTD yang ketara dalam kalangan kategori demografi dan gaya hidup tertentu, menekankan keperluan untuk pengurusan yang disasarkan dan strategi pencegahan.

Kata kunci: FLUTD, manifestasi klinikal, insiden, dan pencegahan

CERTIFICATION

This is to certify that we have read this research paper entitled **'Occurrence of Feline Lower Urinary Tract Disease (FLUTD) Cases in Kota Bharu District, Kelantan Within The Period Of June Until October 2024'** by **Ahmad Jafni Bin Ahmad Hizad** and in our opinion, it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirements for the course DVT 55204 – Research Project.

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LIST OF ABBREVIATIONS

FLUTD	–	Feline Lower Urinary Tract Disease
THP	–	Tamm-Horsfall glycoprotein
USG	–	Urine Specific Gravity
FIC	–	Feline Idiopathic Cystitis
GAG	–	Glycosaminoglycan
UTI	–	Urinary Tract Infection
DSH	–	Domestic Short Hair

CHAPTER 1

INTRODUCTION

Feline Lower Urinary Tract Disease, commonly known as FLUTD, is a serious health problem affecting cats worldwide. FLUTD is the general term that compasses many disorders, such as feline idiopathic cystitis, urethral obstructions, urolithiasis, urinary tract neoplasia, and urinary tract infection (Fitriah *et al*., 2018). This disease usually attacks the bladder, urinary tract and reproductive tract, typically affecting the cat's urination activity. This condition can potentially lead to signs of blood in the urine (hematuria), urinary straining (stranguria), inappropriate urination (periuria), and dysuria (Care, 2020).

The underlying causes of FLUTD vary and include diet, hydration status, urine pH, stress, heredity, and lifestyle (Lue *et al*., 2008). Because of their low moisture content, dry cat food diets have been linked to the development of FLUTD, resulting in concentrated urine and an increased risk of crystal formation (Cooper, 2015). On top of that, FLUTD can be seen in cats of any age and can be attached to any sex (Moore, 2003). In Malaysia, FLUTDs are commonly affected in domestic short hair and indoor lifestyle cats, which are the most affected. Middle-aged cats with ideal body weight commonly succumbed to the disease (Rosdi, 2023). Several countries, including Indonesia (Fitriah *et al*., 2018), Thailand (Nithin *et al.*, 2023), and Norway (Sævik *et al*, 2011), have provided data on the prevalence rate in their country.

In general, FLUTD is categorized into two conditions. The first one is obstructive, and the second one is non-obstructive. According to Moore (2003), obstructive FLUTD is caused by the inflammatory debris from feline idiopathic cystitis (FIC), urethral plugs or uroliths. Non-obstructive FLUTD causes include FIC, uroliths, urothelial carcinoma, anatomic defects (such as urethral stricture) and urinary tract infection. Urethral plugs might include an aggregation of inflammatory cells, erythrocytes, and a matrix of proteins and crystals. Studies have proven that struvite is the most common crystal detected in urethral plugs, mainly in feline species. According to Grauer, the two mainly found in feline

uroliths are calcium oxalate and struvite (Cooper, 2015). Tamm-Horsfall glycoprotein (THP) appears to increase the development of struvite crystals in feline urine (Matsumoto, 2008). Other than that, a study also mentioned that bladder neoplasia is uncommon in cats; however, it is more common in cats older than ten years (Sandy, 2024).

In addition, there are several methods for assessing and diagnosing FLUTD. The assessment includes physical examination, laboratory urinalysis and diagnostic imaging (ultrasound and abdominal radiograph). Physical examination comprised measurements of body temperature, heart rate, breathing rate, mental state, mucous membrane color, capillary refill time, cardiopulmonary auscultation, and abdominal palpation (Neri, 2016). One of the important clinical examinations revealed a large bladder (Kershaw, 2019).

A urinalysis is crucial for determining urinary tract disease's occurrence, severity, and duration (Sink, 2011). A complete urinalysis examines color, odor, turbidity, volume, pH, specific gravity, protein, glucose, ketones, blood, erythrocytes, leukocytes, epithelial cells, casts, crystals, and organisms (Yadav, 2020). The urine was collected via various methods, including manual compression, cystocentesis and urinary catheterization. Usually, urinalysis is performed using commercial urine dipstick analysis, whereas a refractometer measures urine specific gravity (USG), and the microscopic examination of the urine sediment is performed (Lund, 2013). The imaging technique allows assessment of the presence of uroliths and evaluation of the bladder and urethra wall. Besides, complete blood cell counts, and serum biochemical profiles are typically ineffective for cats with lower urinary tract symptoms unless they are accompanied by other disorders (Lulich, 2007).

A private veterinary clinic operated in Kota Bharu, Kelantan, was selected as benchmark to conduct this research. With a strength of 3 vets and 8 veterinary assistants, they are often referred to handling and treating small animal cases. The private veterinary clinic sees many feline patients yearly, including those with FLUTD. Nevertheless, no studies related to FLUTD have been conducted. Thus, the current study established prevalence, clinical signs, aetiology, and risk factors for FLUTD in cats in the Kota Bharu district.

1.1 RESEARCH PROBLEMS

Recurrence cases of FLUTD are always reported, which increases the treatment cost and has financial implications for pet owners. Some pet owners also fail to recognize the abnormal behaviours shown by their cats, which are suspected to be FLUTD cases, thus delaying the appropriate diagnosis and treatment. Studies and research have been conducted on FLUTD cases worldwide and in Malaysia. Yet, there is no record or evidence of the prevalence and recurrence rates in the Kota Bharu district. In addition, information related to risk factors for FLUTD is also limited. Thus, this study investigates the prevalence and recurrence rates of FLUTD in Kota Bharu districts from June until October 2024.

1.2 RESEARCH QUESTIONS

I. What are the prevalence and recurrence rates of FLUTD cases in Kota Bharu district from June to October 2024?
II. What risk factors are associated with FLUTD in Kota Bharu district from June to October 2024?

1.3 RESEARCH HYPOTHESIS

I. The prevalence and recurrence rates of FLUTD cases in the Kota Bharu district were relatively high to moderate from June to October 2024.
II. The risk factors associated with FLUTD are age, sex, weight, diet, breed, dietary intake, living conditions, and urinary crystals.

1.4 RESEARCH OBJECTIVES

I. To determine the prevalence and recurrence rates of FLUTD cases in Kota Bharu district from June to October 2024
II. To investigate risk factors contributing to the recurrence of FLUTD cases in the Kota Bharu district.

CHAPTER 2

LITERATURE REVIEWS

2.1. Common causes of FLUTD.

Urolithiasis is a general term describing the formation of the urinary stone in the urinary tract. In the case of FLUTD, it can occur anywhere in the kidneys, bladder, ureters, and urethra. These uroliths can block the lumen of the urinary tract and cause irritation and inflammation. Some uroliths commonly found in cats are struvite (magnesium ammonium phosphate) or calcium oxalate (Acierno, 2022).

Next, anatomical abnormalities are rarely related to FLUTD. The anatomical defects include the urinary bladder diverticulum, urethral stricture, and urethra malposition (Forrester, 2007). Clinical research indicates that disorders that increase intravascular pressure can cause potential diverticula to open (Senior, 2006). The diverticula can dissolve once the underlying cause of increased pressure is removed.

Urinary tract tumours can also cause FLUTD. The prevalent bladder tumours in cats are transitional cell carcinoma, urothelial carcinoma, squamous cell carcinoma and lymphoma (Moore, 2003). Feline idiopathic cystitis (FIC) is a typical cause of FLUTD in young cats. As the term “idiopathic” suggests, the exact cause is unknown. However, new research proposes that FIC may be caused by changes in the relationship between the neuronal supply to and from the bladder, the protective glycosaminoglycan (GAG) layer that lines the bladder, and substances within the urine. Urine’s pH can vary extensively, and it may contain rough crystals, toxins, and irritants (Brooks, 2023).

Other than that, urethral obstruction, bacterial urinary tract infection, behavioral and environmental stress and diet-related issues (e.g. high magnesium) can also cause FLUTD.

2.2. Clinical manifestation and risk factors of FLUTD in cats.

When the owner consults with the veterinarian, the obvious complaint about their pet is that the cat may show clinical signs of hematuria, stranguria, periuria and dysuria. This was the first information for the veterinarian to rule out the diagnosis of FLUTD. In comparison, the risk factors vary across the country. In New Zealand, there was a lack of physical activity (Jones *et al*., 1997), while in Austria, obese cats had an increased prevalence of FLUTD (Zeller *et al*., 2015). In Bangkok, Thailand, a commercial dry food diet and being overweight increased the risk of FLUTD (Pusoonthornthum *et al.*, 2012). However, no article discusses the risk factors of FLUTD in Malaysia.

A study conducted in Thailand stated that risk factors of a breed of cat are associated with FLUTD cases in their country. FLUTD was frequently found in cats with domestic shorthair, followed by Persian, American shorthair, exotic shorthair, Scottish fold, and Siamese (Piyarungsri *et al.,* 2020). Cats aged 4 to 10 years had a higher risk of urolithiasis and idiopathic cystitis, but cats 10 years and older were considerably exposed to the potential risks of UTI and neoplasia (Dorsch *et al.,* 2014).

2.3. Diagnostic measures to confirm FLUTD

An accurate diagnosis of FLUTD is required for effective management and medication options. For evaluating cats with lower urinary tract symptoms, veterinarians use a combination of diagnostic approaches, such as history collection, physical examination, urinalysis, and imaging techniques.

Before further investigation, a veterinarian started doing a physical examination such as taking the rectal temperature, auscultating the heart and palpating the urinary bladder. The affected cat's body temperature was 38.3℃, heart rate was 157 beats/min, and bladder fullness fluctuated with palpation (Ping, 2022).

Then, urinalysis is a vital laboratory test commonly conducted in veterinary practice and included in a minimal database. It is beneficial for documenting different forms of

urinary tract disorders. Urine can be collected via cystocentesis, urethral catheterization, or forcing the cat's bowel movements. It should be evaluated within 30 minutes. A standard urinalysis is performed using a refractometer to measure the urine-specific gravity and examine the urine sediment under the microscope to identify crystals and cell debris (Sjetne *et al*., 2013).

On top of that, ultrasonography and X-ray are used to detect urinary calculi and inflammation (Fitriah *et al*., 2018). The patients were placed in lateral recumbency, and the examination was conducted. For example, abdominal ultrasound can detect intraluminal masses, bladder wall thickening, and kidney parenchymal abnormalities. Unfortunately, ultrasound cannot image the urethra, but it can reveal enlarged ureters (Sant, 2012). Other than that, the radiographic findings were consistent with the following abnormalities. Plain radiographs can show ureteral calculi with sufficient contrast. Calcium oxalate is the most prevalent ureteral calculus in cats (Bovens, 2011).

Urine cytology involves microscopic examination of urinary sediment to diagnose FLUTD. A fresh urine sample, obtained via cystocentesis, catheterization, or free catch, is centrifuged to concentrate cells. The sediment is stained (e.g., Diff-Quik) and examined for red and white blood cells, crystals, epithelial cells, bacteria, or other abnormalities indicating FLUTD causes. Also, urine cytology may indicate large epithelial cells with anisocytosis and anisokaryosis in the case of urinary tract tumours.

2.4. Treatment and management of FLUTD cases in cats

Based on available evidence, a cat suspected of FLUTD usually takes a week to recover, but if there is a simultaneous infection, antibiotics are suggested for seven days, therefore, ciprofloxacin for one week was prescribed (Hostutler, 2005). In addition, the medication was able to resolve the clinical signs. Previous research indicates that obstructive and non-obstructive diseases have recurrence rates of 45% and 39% within 6 months and 1 year, respectively, indicating potential for improvement (Hostutler, 2005).

Next, opioid analgesics such as butorphanol, buprenorphine, and fentanyl (Chew

et al., 2011) and NSAIDs include carprofen, ketoprofen, meloxicam, piroxicam, and robenacoxib (Hostutler, 2005) that are beneficial for cats with FIC and may benefit from relieved bladder pain and reduced clinical symptoms. Next, supportive fluid therapy is required to balance electrolytes and stabilize cardiovascular and metabolic disorders (Cooper, 2015). To eliminate the obstruction, attempt decompressive cystocentesis, retrograde urethral flushing, and indwelling urethral catheterization with a sterile closed collecting system for 24-48 hours (Cooper *et al*., 2010).

Further hospitalized medical management was to be usually required. If urinary blockage recurs rapidly and frequently after initial treatment, surgery, such as perineal urethrostomy, is advised (Alicia *et al.,* 2018). Finally, most veterinarians would give dietary recommendations. Wet diets have likely been shown to reduce the recurrence of episodes, while dry diets should include water in the food or provide a ready supply of fresh water. Optimizing water availability, such as using fountains versus still water, can be beneficial (Sturgess, 2016).

2.5. Prevalence of FLUTD in other countries.

Feline Lower Urinary Tract Disease (FLUTD) refers to a variety of urinary system diseases that affect cats all over the world. These factors can have a substantial impact on feline health and welfare. While the prevalence of FLUTD varies by geography and population, it is still a major concern for veterinarians and pet owners worldwide.

During the study period conducted in Seoul, Korea, 4014 cats were registered at the practice, and 107 of them fit the case definition of FLUTD, resulting in a period FLUTD prevalence of 2.67% (Kim *et al.,* 2018). Domestic shorthair was the most prevalent breed, followed by Persian and Scottish Fold in both cases and controls.

In 2020, lower urinary tract disease was included among Yogyakarta, Indonesia's 25 most common feline disorders (Nururrozi *et al.,* 2020). The same tendency was also observed in Thailand. Cat owners in Thailand commonly express concern about this issue. Older cats that have already experienced FLUTD are more likely to develop kidney disease (Nithin *et al.*, 2023). In Norway, 119 cats with FLUTD were included, 34 patients

were diagnosed with obstructive FLUTD, and 85 with non-obstructive FLUTD (Sævik *et al*, 2011).

CHAPTER 3

MATERIALS AND METHODOLOGY

3.1 Study Area and Target Population

The study was carried out at the VoV Animal Medical Centre, Kota Bharu, Kelantan. The target population was the cats presented to VoV Animal Medical Centre related to FLUTD cases starting in June and continuing until October 2024. The owners were further interviewed to get the full history and information of the patients related to FLUTD cases. The population size would be at least 30 cats associated with FLUTD.

3.2 Sample Collection and Procedures

Data collection included history taking, physical examination, radiography, ultrasonography, and urinalysis. The attending clinician supervised the student for the data collection.

3.2.1 History taking

The information was gathered through a client complaint asking the reason for the visit. The breed, sex, and age were determined by asking the owner or checking the patient ID on the card, if any. Then, a further question regarding the cat's diet is whether it consumes dry, wet food or any specialized diet. The cat owners were asked about their living conditions, including whether they are primarily indoors or outdoors.

After that, the owners were asked what symptoms or behaviours they had observed in their cats. For example, frequent urination, straining to urinate, and the presence of blood in the urine. The clinical signs' duration and progression were further asked to know more about the onset and duration of FLUTD-related issues.

3.2.2 Physical examination

A complete physical examination of the cat was performed to determine its overall health and identify any abnormalities. This may require palpating the abdomen to check for bladder distention or discomfort and examining the urethral region for signs of inflammation or discharge.

3.2.3 Radiography (X-ray)

Abdominal radiographs were used to determine the shape and size of the bladder, detect urinary stones, and check for evidence of urinary tract obstruction or other abnormalities.

3.2.4 Ultrasonography

Abdominal ultrasound imaging was performed to provide precise views of urinary tract structures such as the bladder, kidneys, and ureters. Ultrasonography was used to detect the thickening of the bladder wall, bladder stones and urinary tract tumours, and other abnormalities associated with FLUTD.

3.2.5 Urinalysis

Urinalysis helps to evaluate urine concentration, the presence of blood and crystals, and determine the pH and specific gravity. All these criteria can provide valuable information about urinary tract health and identify underlying diseases to guide us in effective treatment.

Chapter 4

4.1 Demographic Data of FLUTD Cases

The records of 3373 feline cases were presented between June 2024 and October 2024 and were reviewed with the aim of investigating the FLUTD incidence. A total number of 23 FLUTD cases were recorded. The demographic data of FLUTD cases are shown as follows.

4.1.1 Sex

Out of 23 FLUTD cases recorded was tom cats diagnosed with FLUTD had 22 cases (95.65%), while only one case (4.35%) was recorded in a queen (Table 4.1).

Table 4.1: Total number of FLUTD cases based on sexes.

Sex	Number of cases	Percentage (%)
Male	22	95.65
Female	1	4.35

4.1.2 Breed

For the feline breed, there were a significant number of Domestic Shorthairs predisposed to FLUTD, which were 17 cases (73.91%), while British Shorthairs had 5 cases (21.74%) and Domestic Longhair had only one case (4.35%) (Table 4.2)

Table 4.2: Total number of FLUTD cases based on breed.

Breed	Number of cases	Percentage (%)
Domestic Shorthair	17	73.91
British Shorthair	5	21.74
Domestic Longhair	1	4.35

4.1.3 **Age**

For the life stage of the feline, no case was recorded for kittens (<1 year old). Then, 20 cases (86.96%) were recorded in young adults (1-6 y/o), for mature adults (7-10 y/o) was one case only (4.35%) and in senior patients (>10 years old) were 2 cases (8.69%) recorded (Table 4.3).

Table 4.3: Total number of FLUTD cases based on life stage.

Life stage (age)	Number of cases	Percentage (%)
Kitten (<1 year old)	0	0
Young adult (1-6 y/o)	20	86.96
Mature adult (7-10 y/o)	1	4.35
Senior (>10 years old)	2	8.69

4.1.4 **Dietary intake**

In terms of dietary intake record, the number of cats fed with the dry type of feed was 14 cases (60.87%), special dietary intake was 6 cases (26.09%) and wet food was 3 cases (13.04%) as shown in Table 4.4.

Table 4.4: Total number of FLUTD cases based on dietary intake.

Type of diet	Number of cases	Percentage (%)
Dry food	14	60.87
Special food	6	26.09
Wet food	3	13.04

4.1.5 **Cat Living Management**

Most cats were kept indoors by the owner in 14 cases (60.87%) followed by 9 cats (39.13%) were managed outdoor cats (Table 4.5).

Table 4.5: Total number of FLUTD cases based on management.

Management	Number of cases	Percentage (%)
Indoor	14	60.87
Outdoor	9	39.13

4.1.6 **Clinical signs**

Upon the cats presented at the clinic, several clinical signs were observed, 19 cats experienced stranguria (82.61%), hematuria were 11 cases (47.83%), periuria were 7 cases (30.43%) and dysuria were 4 cases (17.39%) (Table 4.6).

Table 4.6: Total number of FLUTD cases based on clinical signs.

Clinical signs	Number of cases	Percentage (%)
Stranguria	19	82.61
Hematuria	11	47.83
Periuria	7	30.43
Dysuria	4	17.39

4.1.7 Diagnostic work-up

Various diagnosis workups were performed to diagnose FLUTD at VOV Medical Centre. Physical examination was conducted in 17 cases (73.91%) to determine the size and texture of the bladder. Ultrasound was also conducted and recorded in 12 cases (52.17%) while X-ray and urinalysis were not performed due to time constraints and upon owner request (Table 4.7).

Table 4.7: Total number of FLUTD cases based on diagnostic workout.

Diagnostic work-up	Number of cases	Percentage (%)
Physical examination	17	73.91
Ultrasound	12	52.17
X-ray	0	0
Urinalysis	0	0

4.1.8 Diagnosis

FLUTD in cats presented to VoV Medical Centre was diagnosed as stated in Table 4.8. FIC were recorded in 14 cases (60.87%), followed by urolithiasis and UTI, 8 cases, respectively (34.78%) and urethral obstruction were 7 cases (30.43%. There was no neoplasia cases diagnosed during the study.

Table 4.8: Total number of FLUTD cases based on diagnosis.

Diagnosis	Number of cases	Percentage (%)
FIC	14	60.87
Urolithiasis	8	34.78
UTI	8	34.78
Urethral obstruction	7	30.43
Neoplasia	0	0

4.1.9 Treatments

Various treatment choices were prescribed for the affected feline to resolve the clinical signs and improve their quality of life. For example, kidney supplements were administered in 18 cases (78.26%), anti-inflammatory in 16 cases (69.57%), antibiotics were given in 12 cases (52.17%), and fluid therapy administration in 10 cases (43.48%) (Table 4.9).

Table 4.9: Total number of FLUTD cases based on treatment of choices.

Treatments	Number of cases	Percentage (%)
Kidney supplement	18	78.26
Anti-inflammatory	16	69.57
Antibiotic	12	52.17
Fluid therapy	10	43.48

4.2 Recurrence case

Seven cats brought to VoV Medical Centre were recorded to have recurrent FLUTD cases (30.43%), while 16 (69.57%) were non-recurrence cases (Table 5.0).

Table 5.0: Total number of FLUTD cases based on recurrent cases.

Recurrence	Number of cases	Percentage (%)
Non-recurrent cases	16	69.57
Recurrent cases	7	30.43

4.3 Prevalence of FLUTD cases in Kota Bharu between June to October 2024.

Figure 1 illustrates the prevalence of FLUTD cases in Kota Bharu district from June until October 2024. A total number of 23 FLUTD cases were recorded. The highest number of FLUTD cases was observed in August, with 8 cases representing 34.78 %. Meanwhile, the lowest number of cases was observed in October, with only 1 case seen (4.38%). Starting from June 2024, there was a steadily increasing number of cases, with 4 cases recorded, and subsequently, it increased to 6 cases in July and reached its peak in August. However, the trends start to decrease in September by 4 cases and drop to 1 in October.

The peak of FLUTD cases was recorded in August, it may be associated with seasonal factors and other risk factors such as sex, age, breed, diet, and management. Additionally, the decline in cases observed in October could indicate the early intervention and treatments in the local veterinary clinic during the later months.

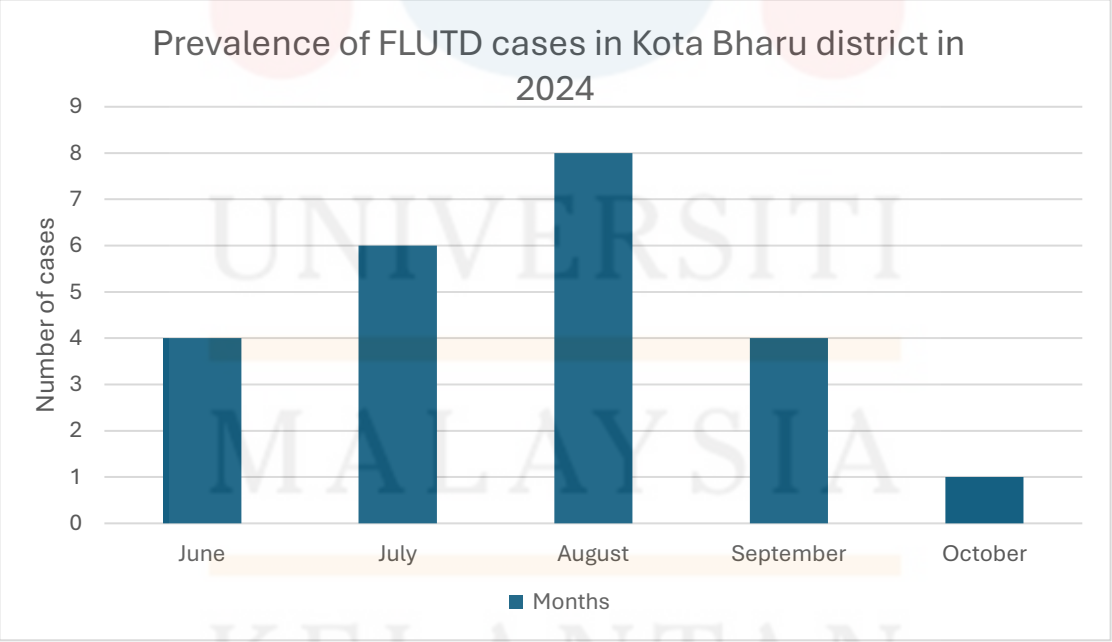

Figure 1: Prevalence of FLUTD cases in Kota Bharu district in 2024

CHAPTER 5

DISCUSSIONS

FLUTD is more susceptible to tomcats than queen (Segev et al., 2011) due to their narrow and long urethra quickly becoming blocked by urolith or urethral plugs (Cooper, 2008). When the urethra is partially or obstructed, urine cannot drain from the bladder, causing fluid, electrolyte, and acid-base imbalances. Also, hormone-related factors cause neutered male cats to have minimal or absent testosterone production. Thus, it may reduce the development of the urethra lumen (Danièlle Gunn-moore, 2003). This study also observed a similar pattern where FLUTD is very prominent in tom cats.

DSH cats are often a cross between multiple genetic lines, without the selective breeding found in pure breeds such as BSH. This blend may have qualities that are not optimal for urinary health. It was mentioned that BSH cats, on the other hand, frequently undergo selective breeding, which may protect them from some risk factors for FLUTD (Little, 2011). As observed in the current study, DSH-breasted cats are more predisposed to develop FLUTC than other breeds. On the other hand, DSHs are more commonly owned by cat owners who live in the Kota Bharu district.

On top of that, factors, such as age, where FLUTD is significantly more susceptible in cats aged 1-6 years/old compared to 7-10 years/old. Based on a study conducted by (Remer *et al*. 2014), the frequency of urethral plugs was highest in cats aged 2-7 years. At the same time, cats aged 4-10 years had a higher incidence of urolithiasis and idiopathic cystitis. Moreover, cats aged 10 and up were more likely to develop UTI and neoplasia (Sævik *et al*., 2011).

In recent studies, cats with dry food are prone to getting FLUTD because the sodium and phosphorus content is likely higher than wet food. After all, dry food is low in moisture. The major use of phosphorus in dry food is to act as a preservative in foods to

lengthen shelf life and add texture to make them more appealing. Inorganic phosphorus compounds include calcium monophosphate, sodium monophosphate, and sodium dihydrogen phosphate (Chris, 2023). As a result, this high mineral content in the food makes it more concentrated. Compared with wet food, the advantage of feeding a canned diet is the additional water content. Cats with health issues that necessitate a higher-than-average water intake, such as kidney illness, diabetes, or lower urinary tract disease, may benefit from the added water in these diets (Meeks, 2021). However, for certain cats with a history of bladder & kidney problems, the owner might change their diet to treat the urinary tract. It usually contains low magnesium with a special compound to dissolve urolith formation and dilute the urine.

The demographic data shows indoor cats are at (60.87%) risk of FLUTD compared to cats left outdoors. This study shows the level of urbanization might be one of the reasons how the cat was managed at the house. There are several possible explanations for this finding. The owners, having the strongest attachment to pets, kept them indoors, encouraging them to seek higher veterinary care for their pets (Lue *et al*., 2008). Thus, indoor cat owners may spend more time with their pets, allowing for better observation of disease symptoms and prompt medical care when necessary.

A prominent clinical sign shown by the cats observed in this current study is stranguria (82.61%), which reflects the owner had noticed their cat was struggling during urination inside the litter box and was not urinating for several days before being presented to the veterinary clinic. This evidence suggests that this clinical sign is often associated with urinary crystals, bladder stones, or urethral obstruction. Other than that, the direct observation by owners noticed hematuria (47.83%) upon urine collection due to bladder mucosal hemorrhage. This finding occurs with ascending bacterial infections where bacteria enter the body through the urethra and cause inflammation (cystitis), while urolith also can irritate the lining of the bladder or the urethra, causing painful urination and bleeding (Schwarzman, 2024). For signs of periuria (30.43%) and dysuria (17.39%), the major concern of the owner is when the cat does not use the litter box provided during urination and sometimes causes the urine to drip around the environment. However,

these signs rarely indicate a specific cause (Danièlle Gunn-moore, 2003).

During consultation with the veterinarian at VOV Medical Centre, the first diagnostic work-up was a physical examination (73.91%). The common findings were enlargement of the bladder and turgid. Upon palpation, the cats would struggle and vocalize due to the pain when pressure was applied to the bladder. Thus, to empty the bladder, instead of manual compression, catheterization becomes a choice to ease urination and relieve obstructions (Schuster, 2023). On the other hand, an ultrasound (52.11%) was carried out to determine the inflammation and presence of sediment in the bladder. Usually, hyperechoic images of the bladder are associated with the presence of uroliths (Kaul *et al.,* 2019). This diagnostic meets the investigation on the formation of crystal struvite and oxalates observed in most urolithiasis cases (Soedarmanto Indarjulianto, 2020). However, in some cases, an approach to conduct an X-ray and urinalysis to obtain confirmatory agents/causes was not performed due to certain limitations by the owner.

Various diagnoses of FLUTD were determined in this study. Feline Idiopathic Cystitis (FIC) had the highest incidence of cats in the Kota Bharu district, Kelantan (60.87%). According to Gerber et al 2005, multiple studies have identified FIC as the main trigger of FLUTD. However, the specific etiological factor is still unknown. FIC can cause inflammation of the urethra, muscular spasms, reflex dyssynergia, and the production of matrix-crystalline urethral plug (Kruger *et al*., 2009). Next, urolithiasis, with 34.78% cases, was also observed. This problem may arise when crystals accumulate in the kidney, bladder and urethral lumen. Most cases of urolithiasis show the production of crystal struvite and oxalates in the urinary tract lumen (Soedarmanto Indarjulianto, 2020). These agents can also cause irritation and blockage upon flowing in the urine, thus raising the clinical signs discussed before. After that, urinary tract infection (UTI) was also ruled in this study. Feline UTI bacteriology tests usually reveal the presence of opportunistic bacteria such as *Escherichia coli*, *Enterococcus spp*., and *Staphylococcus felis* (Litster *et al*., 2009). Female cats are more likely to have bacterial urinary tract infections, according to (Kaul *et al*., 2019). However, UTI can occur in healthy male cats who are catheterized.

Another study also mentioned the infection risk increases with the duration of catheterization (Dokuzeylül *et al*., 2015). Urethral obstruction was also observed (30.43%). Urinary stones and urethral plugs (soft materials including minerals, cells, and mucus-like protein) are two common blockage causes. Once the urethra is closed, urine returns to the kidneys and causes hydronephrosis. Without therapy, the kidneys fail to excrete out the waste products and, further, cause toxins to accumulate in the blood and cause electrolyte imbalances, ultimately leading to death (Hetrick and Davidow, 2013). There were no significant findings for neoplasia in this study, where neoplasia is commonly diagnosed ultrasonographically by identifying a mass lesion. Transitional cell carcinomas (TCC), adenocarcinoma, leiomyoma, and other tumours can develop in cat bladders. However, TCC is encountered most (Danièlle Gunn-moore, 2003).

Normally, for cats suffering from severe dehydration and hematuria due to FLUTD, fluid therapy using normal saline (0.9%) was provided. It is included to relieve urine content in the bladder via bladder flushing. According to Rafique, 2014, infusion of normal saline at 150 ml/day for the first 7 days and 75 ml/day for up to 14 days intravenously is helpful to promote a good recovery in just two weeks. On top of that, an oral anti-inflammatory tablet, such as Beazyme, has papain-proteolytic enzymes that can subside the inflammation in the urinary tract, especially the bladder. However, using NSAIDs, such as meloxicam or piroxicam, seems to be quite beneficial. In addition to reducing inflammation, these medications also have an anti-cancer effect on some tumours and are typically well tolerated (Strickland, 2018). For antibiotics, there are several recommendations; for example, ciprofloxacin (Rafique, 2014) stated one week was recommended as *E. coli* infection was present. A supportive treatment would be ideal for maintaining a healthy bladder and nervous system by prescribing Cystophan. One of the important ingredients is glycosaminoglycan, which can coat a protective layer on the wall of the urinary bladder. Tryptophan aids in maintaining and strengthening the protective glycosaminoglycan (GAG) of the bladder layer. Additionally, it contains L-tryptophan, which the brain uses to produce serotonin (Gunn-Moore, 2014).

Out of the total cases documented during the study period, 69.57% (16 cases) were non-recurrent, suggesting that they were resolved or treated without recurrence within the timeframe. This shows that early interventions, such as dietary changes, improved hydration, and stress management, may have prevented recurrence in these patients. However, 30.43% (7 cases) were classed as recurrent, indicating that these cats suffered multiple episodes of FLUTD over the same period.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This study on the Occurrence of Feline Lower Urinary Tract Disease (FLUTD) Cases in Kota Bharu District, Kelantan, from June to October 2024 provides valuable insights into the prevalence and recurrence rates and potential risk factors associated with FLUTD in this region. The findings indicate that FLUTD is a common condition, with a significant proportion of cases occurring in Domestic Shorthair (DSH) cats, particularly susceptible to diet, lifestyle, and environmental stress. Additionally, the study reveals a 30.43% recurrence rate, highlighting the tendency to become a chronic issue in some cats, necessitating long-term management. This underscores the multifactorial nature of FLUTD and the challenges in fully preventing recurrence, especially among high-risk populations.

A few recommendations are proposed to improve future research on this topic. The sample size shall be increased by involving multiple veterinary clinics to obtain a comprehensive dataset. Second, research should identify and confirm the seasonal pattern of FLUTD cases. It would clarify and provide valuable insights to determine strategies during high-risk months. Finally, the lack of references and local studies on FLUTD in Malaysia complicates explaining the research. Researchers should emphasize doing and publishing additional localized studies to establish a body of knowledge on FLUTD in Malaysia.

CHAPTER 7
APPENDICES

Figure 2: Add a few drops of urine to the urine strip.

Figure 3: Example of urinalysis result.

Figure 4: The wall bladder thickening upon ultrasound on the bladder.

Figure 5: Presence of urolith (struvite) in FLUTD case.

Figure 6: Presence of hematuria upon bladder compression

CHAPTER 8

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