

KNOWLEDGE, ATTITUDE, AND PRACTICES  
TOWARD CHRONIC KIDNEY DISEASE IN  
DOGS AND CATS AMONG PET OWNERS IN  
KLANG VALLEY, MALAYSIA

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DEGREE OF VETERINARY MEDICINE

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Knowledge, Attitude, and Practices toward Chronic Kidney  
Disease in dogs and cats among pet owners in Klang Valley,  
Malaysia

By

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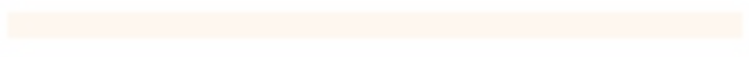
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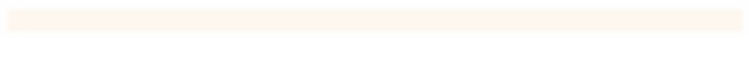
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**Knowledge, Attitude, and Practices toward Chronic Kidney Disease in dogs and cats among pet owners in Klang Valley, Malaysia**

**ABSTRACT**

Chronic kidney disease (CKD) is the most recognized form of kidney disorder in dogs and cats. It is defined as structural and/or functional impairment of one or both kidneys. Adequate related knowledge among pet owners helps increase their awareness towards CKD and adopt healthy attitudes and practices for their pets. This study aimed to (i) assess the knowledge, attitude, and practice (KAP) of dog and cat owners towards CKD; (ii) determine if socio-demographic characteristics and pet ownership influence KAP; and (iii) examine the association between the level of KAP. A cross-sectional online and physical survey was conducted and a total of 111 pet owners participated in this study. Data collected were descriptively analyzed and associations were determined using the Chi-square test and Spearman's correlation analysis with IBM SPSS Statistic version 27.0. Most respondents had moderate knowledge ( $n = 61, 55\%$ ), attitudes ( $n = 55, 49.5\%$ ), and practices ( $n = 69, 62.2\%$ ) towards CKD in dogs and cats. Significant associations were indicated between education level, management of dogs, and pets diagnosed with CKD and ongoing treatment with knowledge ( $p$ - value  $< 0.05$ ). Significant associations were also indicated between gender and number of pet-owned with attitude ( $p$ - value  $< 0.05$ ). A significant positive correlation between total knowledge and attitude score ( $r = 0.190$ ) was indicated in this study. Moderate knowledge of CKD in dogs and cats among pet owners in this study implied the need for improvement in the understanding of CKD with early diagnosis and management through continuous awareness and education initiatives.

***Keywords: Chronic Kidney Diseases; Pet owners; Knowledge, Attitude and Practices of Pet owners***

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**Pengetahuan, Sikap dan Amalan terhadap Penyakit Ginjal Kronik pada anjing  
dan kucing dalam kalangan pemilik haiwan peliharaan di Lembah Klang,**

**Malaysia**

**ABSTRAK**

Penyakit buah pinggang kronik (CKD) adalah bentuk gangguan buah pinggang yang paling dikenali dalam anjing dan kucing. Ia ditakrifkan sebagai kerosakan struktur dan/atau fungsi satu atau kedua-dua buah pinggang. Pengetahuan berkaitan yang mencukupi di kalangan pemilik haiwan peliharaan membantu meningkatkan kesedaran mereka terhadap CKD dan mengamalkan sikap dan amalan yang sihat untuk haiwan peliharaan mereka. Kajian ini bertujuan untuk (i) menilai pengetahuan, sikap, dan amalan (KAP) pemilik anjing dan kucing terhadap CKD; (ii) menentukan sama ada ciri sosio-demografi dan pemilikan haiwan peliharaan mempengaruhi KAP; dan (iii) meneliti perkaitan antara KAP. Sebuah kajian keratan rentas dijalankan dalam talian atau fizikal dan sejumlah 112 pemilik haiwan peliharaan mengambil bahagian dalam kajian ini. Beberapa statistik digunakan dalam kajian ini seperti 'Chi-square test' dan 'Spearman's rho correlation' dengan menggunakan IBM SPSS Statisitic versi 27.0. Majoriti responden mempunyai pengetahuan sederhana ( $n = 61, 55\%$ ), sikap serdahana ( $n = 55, 49.5\%$ ), dan amalan serdahana ( $n = 69, 62.2\%$ ) terhadap CKD pada anjing dan kucing. Hasil kajian statistik menunjukkan bahawa terdapat hubungan antara tahap pendidikan, pengurusan anjing, dan haiwan peliharaan yang didiagnosis dengan CKD dan rawatan berterusan dengan pengetahuan (nilai  $p < 0.05$ ). Kajian ini jugak menunjukkan perkaitan yang signifikan antara jantina dan bilangan haiwan peliharaan dengan sikap (nilai  $p < 0.05$ ). Kolerasi positif yang signifikan antara jumlah skor pengetahuan dan sikap ( $r = 0.190$ ) telah ditunjukkan dalam kajian ini. Hasil kajian statistik ini menunjukkan pengetahuan sederhana tentang CKD dalam anjing dan kucing antara kalangan pemilik haiwan peliharaan mempunyai keperluan untuk penambahbaikan dalam pemahaman CKD dengan diagnosis dan pengurusan awal melalui kesedaran berterusan dan inisiatif pendidikan.

***Kata kunci: Penyakit Buah Pinggang Kronik; Pemilik haiwan peliharaan; Pengetahuan, Sikap dan Amalan Pemilik Haiwan Kesayangan***

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## TABLE OF CONTENT

	<b>PAGE</b>
ORIGINAL LITERARY WORK DECLARATION	
ABSTRACT	
ACKNOWLEDGMENTS	
CHAPTER 1 INTRODUCTION	
1.1 Research Background	1
1.2 Research Problem Statement	2
1.3 Research Questions	3
1.4 Research Hypothesis	3
1.5 Research Objectives	4
CHAPTER 2 LITERATURE REVIEW	
2.1 Overview of CKD in Dogs and Cats	5
2.2 Difference between AKI and CKD	5
2.3 Diagnosing CKD	7
2.4 Disease Confirmation and Staging of CKD	7
2.5 Conservative management of CKD	9
2.5.1 Dietary Therapy of CKD	9
2.5.2 Managing Gastrointestinal Signs of Uremia	11

2.5.3	Maintaining Hydration	11
2.5.4	Managing Electrolyte Imbalance	12
2.5.5	Managing Metabolic Acidosis	13
2.5.6	Managing Anemia	14
2.5.7	Managing Proteinuria and Arterial Hypertension.	14
2.6	Prognosis of CKD	15
2.7	Importance of Early Diagnosis and Intervention of CKD	17
CHAPTER 3 RESEARCH METHODOLOGY		
3.1	Study design and study setting	18
3.2	Sample size and sampling method	18
3.3	Inclusion and exclusion criteria	19
3.4	Questionnaire design	19
3.5	Validity and Reliability	20
3.6	Statistical Analysis of Data	21
CHAPTER 4 RESULT		
4.1	Socio-demographic Characteristics of Respondents	22
4.2	Knowledge of CKD in dogs and cats by pet owners	24
4.3	Attitude on CKD in dogs and cats by pet owners	26
4.4	Practice on CKD in dogs and cats by pet owners	28
4.5	Respondents' level of knowledge, attitude, and practice towards CKD in dogs and cats	30



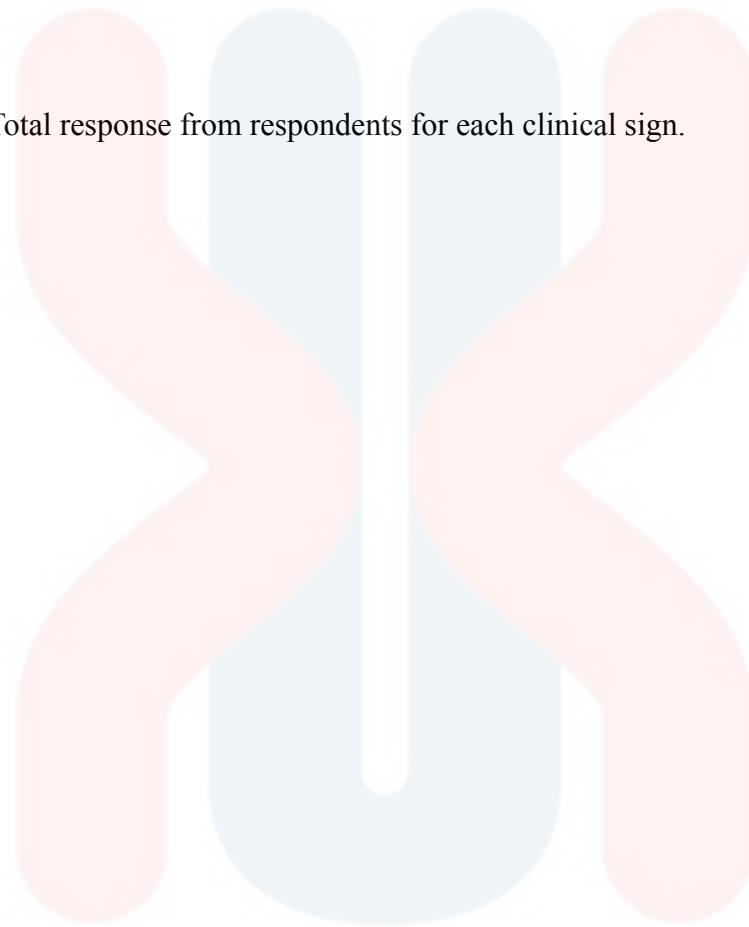
4.6	Association between respondents' selected socio-demographic characteristics and Knowledge, Attitude, and Practice of CKD in dogs and cats.	31
4.7	Correlation between total knowledge, attitude, and practice score of CKD in dogs and cats.	33
	CHAPTER 5 DISCUSSION	34
	CHAPTER 6 CONCLUSION	38
	REFERENCES	39
	APPENDIX A	45

## LIST OF TABLES

<b>NO.</b>		<b>PAGE</b>
4.1	Respondents' socio-demographic characteristics ( <i>n = 111</i> )	23
4.2	Knowledge of CKD in dogs and cats by pet owners ( <i>n=111</i> )	25
4.3	Attitude on CKD in dogs and cats by pet owners ( <i>n=111</i> )	27
4.4	Practice on CKD in dogs and cats by pet owners ( <i>n=111</i> )	29
4.5	Respondent's level of knowledge, attitude, and practice (KAP) towards CKD in dogs and cats ( <i>n=111</i> )	30
4.6	Association between selected socio-demographic characteristics and Knowledge of CKD in dogs and cats	32
4.7	Association between selected socio-demographic characteristics and Attitude towards CKD in dogs and cats	32
4.8	Correlation between total knowledge, attitude, and practice score	33

## LIST OF FIGURES

NO.		PAGE
4.1	Total response from respondents for each clinical sign.	26



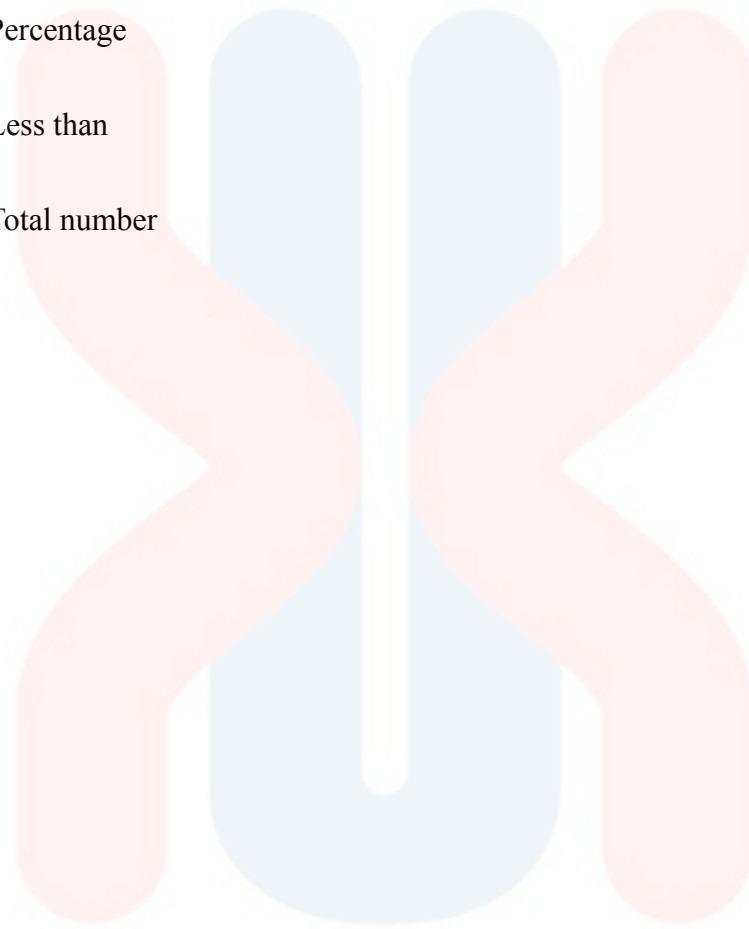
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## LIST OF ABBREVIATIONS

ACEI	Angiotensin- converting enzyme inhibitor
AKI	Acute Kidney Injury
ARB	Angiotensin receptor blocker
CKD	Chronic Kidney Disease
TAS	Total Attitude score
TKS	Total Knowledge score
TPS	Total Practice score

## LIST OF SYMBOLS

%	Percentage
<	Less than
$N$	Total number



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## CHAPTER 1

### INTRODUCTION

#### 1.1 Research Background

Chronic kidney disease (CKD) is the most common renal illness found in older dogs and cats, yet it can affect animals of any age (Renalysfunction in Small Animals - Urinary System, n.d.). It is characterized as structural and/or functional impairment of one or both kidneys that has lasted more than 3 months, and most patients have an irreversible progressive loss of function and structure. The prevalence of CKD is estimated to be 0.5–1.0% in dogs and 1.0–3.0% in cats (De Santis et al., 2022). However, the incidence of CKD increases with age, particularly in cats, where it has been reported to approach 80% in the elderly cat population. (Polzin, 2011)

The degree of functional impairment does not necessarily correspond to loss of structure. The injured kidney may have a certain degree of irreversible loss of its function and/or structure but can remain stable for some period and progress to CKD (Vaidya & Aeddula, 2022). In certain individuals, CKD is complicated by poor renal perfusion and/or obstructive causes, which may worsen the illness but, if treated, may alleviate it (Bartges., 2012).

If given the right therapy and food, animals may survive for lengthy periods with only a fraction of functioning kidney tissue (Renal Dysfunction in Small Animals - Urinary System, n.d.). Treatment is decided on the stage of the disease and the severity of the symptoms. CKD is a slow-progressing disease and frequent evaluation aids in

determining the disease progression as well as choosing a newer and more effective course of therapy (Chen et al., 2019). The owner's awareness of this illness aids in the relief and improvement of the animal's quality of life.

## **1.2 Research Problem Statement**

One of the most serious issues concerning chronic kidney disease in an older animal is that clinical signs are rarely noticed in the early stages of the disease and only appear later (Agraham, 2022). Sometimes the symptoms of CKD can be indistinct and easily attributed to other causes (Mayo Clinic, 2023), some owners are not familiar with the signs of kidney disease, and they may not recognize them. Owners may also not realize their pet is suffering from CKD until they encounter clinical signs that concern them.

Besides that, early detection, and diagnosis of CKD in animals are crucial in helping to slow down the progression of disease and prevent further complications (Whaley-Connell et al., 2011). Early detection of the disease with appropriate therapy and diet given to patients will allow better management in relieving and improving their quality of life. However, most owners are unaware of the importance of early detection and diagnosis, they may have misconceptions that it is a normal aging process, or some may avoid taking their pet to the vet due to financial concerns, and/ or fear of bad news.

### 1.3 Research Questions

- a) Assess the knowledge of dog and cat owners toward chronic kidney disease.
- b) Assess the attitude of dog and cat owners toward chronic kidney disease.
- c) Assess the practices of early detection and management of chronic kidney disease among dog and cat owners.
- d) Determine if socio- demographic characteristics and pet ownership influence knowledge, attitude, and practices of dog and cat owners regarding chronic kidney disease.
- e) Examine the association between the levels of knowledge, attitude, practices of dog and cat owners regarding chronic kidney disease.

### 1.4 Research Hypothesis

- a) Dog and cat owners have poor knowledge of chronic kidney disease.
- b) Dog and cat owners have poor attitudes toward chronic kidney disease.
- c) Dog and cat owners have poor practices in the early detection and management of chronic kidney disease.
- d) There is an association between socio- demographic characteristics and pet ownership with the level of knowledge, attitude and practice of dog and cat owners regarding chronic kidney disease.
- e) There is an association between the level of knowledge, attitude, and practice of dog and cat owners regarding chronic kidney disease .



### 1.5 Research Objectives

- a) To determine the level of knowledge about chronic kidney disease among dog and cat owners in Klang Valley, Malaysia.
- b) To determine the level of attitudes toward chronic kidney disease among dog and cat owners in Klang Valley, Malaysia.
- c) To determine the level of practice in the early detection and management of chronic kidney disease among dog and cat owners in Klang Valley, Malaysia.
- d) To determine the association between socio-demographic characteristics and pet ownership with the level of knowledge, attitudes and practices of dog and cat owners regarding chronic kidney disease.
- e) To determine the association between the level of knowledge, attitude, and practice of dog and cat owners regarding chronic kidney disease.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Overview of CKD in Dogs and Cats

A gradual, irreversible kidney condition that has lasted more than three months is known as chronic kidney disease. According to estimates, 0.5–1.0% of dogs and 1.0–3.0% of cats have CKD. However, the stated frequency of 80% in the elderly animal population increases with age, particularly in cats (De Santis et al., 2022). Differently from human medicine (Johnson et al. 2004), it is not well known how common it is for dogs and cats to be at risk of chronic kidney disease (CKD) (Reynolds et al., 2013).

Despite limited clinical research assessing lifestyle, environmental, or phenotypic risk factors for the onset of canine or feline CKD, certain risk factors have shown association with the occurrence of this disease in cats and dogs. Risk factors that have been identified such as breed, age, comorbidities, drug, and Acute Kidney Injury (AKI) (IRIS Kidney - Education - Risk Factors, 2019).

#### 2.2 Difference between AKI and CKD

The kidneys are the key organ responsible for maintaining homeostasis, removing waste products from the body's metabolism, and controlling blood pressure, blood volume, and pH levels in the system (Ogobuiro & Tuma, 2023). Furthermore, the kidneys are essential for metabolic functions and for controlling erythrocyte mass in response to erythropoietin hormone (Ogobuiro & Tuma, 2023).

Acute kidney injury (AKI), previously known as acute renal failure (ARF) (Goyal et al., 2023), and chronic kidney disease (CKD), are the two categories of renal failure that can occur in dogs and cats. Both are dependent upon the type or onset of the disease. The clinical state known as acute renal failure is defined by the abrupt start of renal hemodynamic, filtration, and excretory failure. This is followed by the buildup of metabolic (uremic) toxins and the dysregulation of fluid, electrolyte, and acid-base balance (Cowgill and Elliott, 2000). In dogs, cats, and humans, the fatality rate from AKI is roughly 50%, notwithstanding the possibility of recovery. (Dunaevich et al., 2020). In dogs and cats, acute renal damage can have many different causes. These fall into several main groups, such as infectious, nephrotoxic, and renal ischemia (Legatti et al., 2018). Prompt diagnostic evaluation of each ARF instance is crucial due to its varied causes; effective treatment relies on identifying the cause. AKI treatment aims to address underlying causes, regulate abnormalities, prevent complications, and provide supportive care. Prognosis for AKI depends on variables like reversible or non-reversible causes, degree of kidney impairment, involvement of other organs, treatment accessibility, and owner compliance. (Dunaevich et al., 2020)

On the other hand, CKD is an irreversible, slow decline in kidney function that lasts longer than three months without presenting any biological or clinical symptoms (Vaidya & Aeddula, 2020). Clinical signs that indicate the kidney's diminished capacity to carry out regular regulatory and excretory functions will appear. Although renal disease can occur at any age, older pets are more likely to have chronic renal disease (Renalysfunction in Small Animals - Urinary System, n.d.). Numerous factors can contribute to this condition, such as immune system disorders, trauma, infections, neoplasms, reduced kidney blood flow, genetic abnormalities, and exposure to toxins.

### **2.3 Diagnosing CKD**

Although not all chronic kidney disease (CKD) patients have the same clinical presentation, the majority exhibit symptoms like loss of body condition, body weight, and muscle mass, as well as an untidy look. The kidneys' incapacity to control the water balance results in polyuria and polydipsia. Some patients may have ulcerative stomatitis, gastroenteritis, vomiting, halitosis, or hyporexia or anorexia. (Foster, 2013)

Patients with CKD have smaller, more irregular kidneys during physical examinations; abdominal radiography and ultrasound can corroborate this. Certain conditions, like renal neoplasia, pyelonephritis, or urethral blockage, cause the kidneys to enlarge and feel uncomfortable when touched. (Polzin, 2013)

Confirming the diagnosis of CKD requires a comprehensive diagnostic evaluation that includes blood pressure monitoring, complete blood count with reticulocyte count, serum biochemical profile, electrolyte and acid-base measurement, and urinalysis with examination of the urine protein: creatinine ratio (Chen et al., 2019). These examinations may reveal underlying causes, ongoing renal damage, and the effects of chronic kidney disease (CKD), offering insights into prognosis and therapeutic objectives. (Foster, 2013)

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### **2.4 Disease Confirmation and Staging of CKD**

Different diagnoses are required for acute kidney injury (AKI) and chronic kidney disease (CKD) due to differences in their prognostic, therapeutic, and diagnostic consequences. However, some patients may experience both AKI and CKD at the same time; this is referred to as acute chronic kidney disease. While AKI may have the potential to be reversible (Goyal et al., 2023), CKD is generally recognized to be an irreversible disease that frequently progresses (Vaidya & Aeddula, 2022).

CKD is a kidney disease that has lasted more than three months. The following factors can support a diagnosis of chronic disease: (1) length of kidney disease as reported by medical history or verified by prior laboratory results (e.g., more than three months of polyuria or polydipsia); (2) physical examination findings consistent with chronic disease (e.g., loss of lean body mass and weight; small kidney size); or (3) evidence of chronic structural abnormalities found by imaging studies or kidney pathology (e.g., small kidneys, unable to distinguish between renal cortex and medulla) (Polzin, 2013).

In dogs and cats, the clinical practice guidelines for diagnosis, prognosis, and therapy are primarily dependent on the disease stage, once it has been established that the damage is caused by a chronic illness. When staging CKD, adherence to the International Renal Interest Society (IRIS) guidelines is advised. Blood pressure, the degree of proteinuria, and serum creatinine concentration are the three main factors used in the four-tier IRIS CKD staging scheme. When a patient has had their serum creatinine concentration measured twice while well hydrated and fasting for at least 12 hours, that information is used to stage their chronic kidney disease. Serum creatinine levels should ideally be monitored over a few weeks to ensure that kidney function is stable, at least temporarily (Polzin, 2013). The degree of proteinuria and arterial blood pressure can then be used to further characterize the staging method to precisely determine the patient's disease stage. All scheduled tests should, however, consider factors like cost, accessibility, invasiveness, and compatibility for the owner's time and capabilities (Quain et al., 2021).

## **2.5 Conservative management of CKD**

Conservative medical management of CKD includes therapies other than treating the kidney disease itself, dialysis, or transplantation. It also includes therapy that prevent further complications that decrease kidney function, provide adequate nutrition to reduce stress or workload on the injured kidney and slow down the loss of kidney function (Polzin, 2013) .

### **2.5.1 Dietary Therapy of CKD**

Feeding a kidney diet designed by a veterinary nutritionist or made especially for managing dogs or cats with CKD is the treatment strategy most likely to improve long-term survival and quality of life for patients with IRIS CKD stages 3 and 4, according to the results of clinical trials. (Jacob et al., 2002; Ross et al., 2006). The favorable effect of renal diets in reducing or delaying the onset of uremia and premature death owing to complications of CKD is clearly supported by the results of various clinical trials. Furthermore, compared to maintenance diets, owners who feed their pets with kidney diets report greater quality of life scores and nutrition maintenance or improvement. (Polzin, 2013)

Diets created especially for dogs and cats with CKD differ from standard general diets in several ways, such as lower levels of protein, phosphorus, and sodium; higher levels of soluble fibre and B vitamins; higher calorie density; no effect on acid-base balance; and the addition of antioxidants and omega-3-polyunsaturated fatty acid supplements (Polzin, 2013). Potassium is added specifically to cat kidney diets. Unfortunately, the phrase "kidney diet" has been misused to suggest that the best option is to simply limit one's protein intake or to create a homemade diet. Feeding general or



senior meals with a lower protein level is not a suitable replacement for feeding diets designed especially for canines and felines with CKD.

While some cats and dogs are more receptive to dietary changes, for many pets it is best to introduce changes gradually. A progressive food change in a dog can take up to a week, and some cats might require a few weeks or even months of adjustment (Polzin, 2013). One way to make the switch is to gradually incorporate the kidney diet into the previous feed. Gradual introduction reduces gastrointestinal issues like diarrhea linked to sudden changes in diet composition and makes it easier for them to accept new foods. Another method would be to put the old and new diets side by side in a different dish and progressively cut back on the old diet. To support the switch to a renal diet, small amounts of gravies or other foods may be added, or the meal may be heated to enhance its palatability. Forcing them to eat is not recommended since this could result in dietary aversion, which can make following this diet extremely difficult or even impossible. When patients have made acceptable efforts to increase their food intake but are still unable to spontaneously ingest enough food to satisfy the primary aim, a feeding tube should be indicated (Polzin, 2013).

Regular monitoring of body weight, body condition score, food consumption (calorie intake), packed cell volume, serum albumin concentration, and quality of life are important ways to assess the nutritional response to diet therapy. Ensuring appropriate food intake, a constant body weight and a body condition score of at least 5/9 are the main objectives (Polzin, 2013)

### **2.5.2 Managing Gastrointestinal Signs of Uremia**

Common gastrointestinal issues in dogs and cats with IRIS CKD stages 3 and 4 include decreased appetite, vomiting, uremic stomatitis and halitosis, gastrointestinal bleeding, diarrhea, and hemorrhagic colitis. The principal aims of the treatment are the reduction of symptoms and any obvious clinical signs. Dietary therapy, especially protein restriction, has been shown to minimize or relieve many gastrointestinal symptoms associated with uremia; nevertheless, antiemetic and antacid therapy may still be necessary in certain individuals (Polzin, 2013). Common gastrointestinal symptoms are treated with three main pharmaceutical classes: sucralfate, which protects mucous membranes from acidic juices, antiemetics, which lessen nausea and vomiting, and H<sub>2</sub> blockers, which decrease stomach activity (Foster, 2013). Despite their effectiveness, none of these drugs have been demonstrated to reduce any clinical symptoms (Roudebush et al., 2009).

### **2.5.3 Maintaining Hydration**

Cats with CKD frequently exhibit dehydration, which can worsen renal function and lead to an acute uremia episode. Limiting fluid intake or encouraging fluid losses, such as vomiting and diarrhea can result in dehydration. Additionally, dehydration can increase the risk of anorexia, lethargy, weakness, constipation, prerenal azotemia, and AKI (Polzin, 2013). Patients who are dehydrated should be rehydrated through parenteral or oral fluid therapy to treat and avoid additional episodes of dehydration and associated side effects (Roudebush et al., 2009).



#### 2.5.4 Managing Electrolyte Imbalance

Phosphorus excretion decreased as renal function began to deteriorate, leading to retention in the body. This could accelerate the development of CKD, tissue calcification, and renal secondary hyperparathyroidism. A lower prognosis has been linked to higher serum phosphorus concentrations, which have been linked to higher mortality or shorter survival times in patients with chronic kidney disease. It has been suggested that therapeutic management of blood phosphorus concentration be initiated for dogs and cats with IRIS CKD stages 2-3, to preserve serum phosphorus concentration within designated target limits (Roudebush et al., 2009). Renal diet therapy reduces phosphorus content; however, it is important to reevaluate serum phosphorus concentration after 4-6 weeks to make sure the treatment goal has been met. A digestive phosphate-binding agent is advised after 4-8 weeks reevaluation has been done and the goal has not been met. (Polzin, 2013). In the gastrointestinal tract, aluminum hydroxide oxide or carbonate salt are frequently used as phosphorus binding agents. Overuse of aluminum can lead to additional problems, so it's advisable to combine it with binders that contain calcium or lanthanum to cut down on aluminum usage (Segev et al., 2008c).

Other than that, cats with stages 2 and 3 of IRIS CKD are more likely to experience hypokalemia and potassium depletion, with a reported incidence of 20–30% (Elliott & Barber, 1998). Conversely, cats that have a considerable decrease in their glomerular filtration rate (GFR), which promotes potassium retention, often have hyperkalemia. Hypokalemia in cats with chronic kidney disease (CKD) can be caused by inadequate potassium intake, increased urine output, and increased renin-angiotensin-aldosterone system activation due to dietary salt limitation. While mild hypokalemia is often asymptomatic, moderate hypokalemia (2.5–3.0 mmol/L) can cause widespread muscular weakness and lethargic behavior. Severe hypokalemia (<2.5

mmol/L) may be associated with overt hypokalemic myopathy. Potassium gluconate and citrate are much recommended for potassium supplementation as compared with potassium chloride which may taste sour and unpleasant. When oral or parenteral potassium supplements are begun, the clinical signs and symptoms of hypokalemic myopathy usually go away in one to five days (Polzin, 2013).

In addition to that, a shortage in calcitriol (active vitamin D) may be linked to chronic kidney disease (CKD) through several processes, such as loss of renal tissue and inhibition of hydroxylation mediated by hyperphosphatemia (Sparkes et al., 2016). Renal secondary hyperparathyroidism results from low calcitriol-induced chronic kidney disease (CKD). In dogs with CKD stages 3 and 4, calcitriol medication has been shown to lengthen survival times by delaying the disease's progression; however, this is not the case for cats with CKD (Roudebush et al., 2009).

### **2.5.5 Managing Metabolic Acidosis**

A laboratory diagnostic used to determine the patient's acid-base state is blood gas analysis. According to Elliott et al. (2003), metabolic acidosis is more common in cats with overt indications of uremia but less common in cats with stages 2 and 3 CKD. Protein nutrition is compromised, and CKD development has been linked to metabolic acidosis. Bicarbonate therapy has been shown to enhance nutritional status and decrease the progression of CKD in humans (De Brito-Ashurst et al., 2009).

When blood pH and bicarbonate concentration fall below normal, dogs and cats with IRIS CKD stages 1-4 are treated with alkalinization treatment. A pH-neutral diet, such as the renal diet, has been shown to improve acidosis. An alkalinizing salt supplement, typically potassium citrate or sodium bicarbonate, can be used to treat both hypokalemia and acidosis when diet alone is insufficient (Polzin, 2013).

### **2.5.6 Managing Anemia**

Lack of erythropoietin is the driving force behind the chronic, progressive, nonregenerative anemia of CKD (Foster, 2013). Besides that, blood loss, poor nutrition, and reduced red blood cell lifespan have certainly contributed to anemia. When patients have anemia, they may present lethargy and impaired appetite. Therapeutic management of anemia due to CKD includes hormone replacement therapy, anabolic steroids, and correcting factors promoting red blood cell loss or impairing red blood cell production. Erythropoietin therapy is most effective therapy, and the common products are human erythropoietin Epogen (EPO) and darbepoetin alpha (DPO). DPO is much recommended as compared to EPO because it may not induce anti-erythropoietin antibodies. Parenteral iron supplementation (Iron dextran) is suggestive because DPO causes strong erythropoietin effect (Polzin, 2013). Monitoring PCV level weekly is needed to adjust the dose needed and gradually reduce the frequency once the PCV has a stable target range (Foster, 2013). The details will be explained in other studies. Cost of the drugs and monitoring needed can be costly for the owners.

### **2.5.7 Managing Proteinuria and Arterial hypertension.**

Urine protein to creatinine ratios (UPC) of greater than 0.5 and 0.4 are more common in dogs and cats diagnosed with IRIS CKD stage 2-4 ("Assessment and Management of Proteinuria in Dogs and Cats: 2004 ACVIM Forum Consensus Statement (Small Animal)," 2005). It is advised to start therapy with a renal diet and administer an ACEI, with the aim of lowering the UPC by half or, preferably, back into the normal range (Sparkes et al., 2016). With such therapeutic management of proteinuria, it is becoming the standard of therapy for individuals with chronic kidney

disease (CKD), while there is less evidence to support the suggestion in dogs and cats. In veterinary medicine, ACEI benazepril and enalapril are frequently used. However, benazepril is more often advised because it is primarily eliminated through the liver rather than the kidneys, which lessens the strain on the injured kidney (Polzin, 2013).

Aside from that, the best antihypertensive medications for dogs and cats with CKD include calcium channel blockers like amlodipine and ACEIs like enalapril and benazepril. Nonetheless, several experimental findings indicate that as an antihypertensive medication for cats, telmisartan, an ARB, at 3 mg/kg administered every 24 hours, may be more beneficial than benazepril (Jenkins et al., 2015). In dogs and cats, arterial hypertension is frequently linked to cardiac (Nelson et al., 2002; Valérie Chetboul et al., 2003), renal, and ocular neurological complications (Advanced Veterinary Medical Imaging, 2014; Sansom et al., 2004).

When a patient is diagnosed with arterial hypertension and there is evidence of retinal lesions, neurological indications, or a systolic blood pressure greater than 200 mm Hg, the decision to begin anti-hypertensive therapy should generally be regarded as an emergency. If not, it is not required. (Polzin, 2013)

## **2.6 Prognosis of CKD**

Increased serum SDMA in dogs and cats had been related to shortened survival times, which in turn had a strong correlation with a decline in GFR, which in fact was linked to a higher chance of dying from severe CKD. (Hokamp & Nabity, 2016) Additionally, SDMA has the potential to be a guanidine uremic toxin and cause cellular damage. (Scheppers et al., 2014) Also, SDMA promotes a decrease in nitric oxide production, which increases the generation of reactive oxygen species and has an inflammatory effect. (Kielstein et al., 2009) The presence of hyperphosphatemia

brought on by a decline in GFR was also linked to a shorter survival time (Perini-Perera et al., 2021) because of contemporaneous physiological changes in the body, including the development of renal secondary hyperparathyroidism and its subsequent consequences, such as renal osteodystrophy. (King et al., 1992) In addition, anemia has been associated with a shorter lifespan duration, which was attributed to negative effects resulting from reduced oxygen delivery, nutrient supply, and oxidative stress secondary to anemia. (Bartges, 2012) Furthermore, because an inflammatory, catabolic, and oxidative condition develops secondary to a cachexic state due to low BCS (Parker & Freeman, 2011), has been tied to a decreased lifespan time. (Morley et al., 2006) Patients with advanced CKD have a shorter lifespan due to all these variables.

The disease will cause most dogs with IRIS CKD stages 3 and 4 to perish away or be euthanized. Dogs with renal failure often live for several months to a year or two, depending on the severity of their condition. Nonetheless, when patients receive the right therapy, their survival periods will be extended. Even though treatment can be adjusted based on the disease, proteinuria, and arterial hypertension are linked to poor prognosis. While the clinical course of CKD in cats varies, most cats with the disease progress considerably more slowly than dogs. However, some cats with the condition progress at the same rate as dogs. Also, for several months or years, some cats with CKD seem to have stable renal function, and they frequently pass away from causes unrelated to CKD. (Polzin, 2013b)

## 2.7 Importance of Early Diagnosis and Intervention of CKD

While prospective, controlled clinical trials are needed to confirm this, it makes sense to believe that early detection and renoprotective treatment of CKD can impede the disease's progression in cats and dogs (Branam, 2022). Research demonstrates that controlling one's diet can impede the advancement of chronic kidney disease (CKD), and mounting data indicates that antiproteinuric medications may also have similar benefit (Elliott et al., 2000; "Evaluation of the Clinical Efficacy of Benazepril in the Treatment of Chronic Renal Insufficiency in Cats," 2006; Ross et al., 2006b). Therefore, to avoid or delay the onset of CKD and lower the likelihood of the morbidity and mortality that are anticipated in later stages of the disease, particularly in IRIS stages 3 and 4, the goal is to identify and control risk factors for CKD. (Polzin et al., 2005).

## CHAPTER 3

### RESEARCH METHODOLOGY

#### 3.1 Study design and study setting

This cross-sectional study was conducted among pet owners, which focused on dog or cat owners, breeders, pet fosterers, or pet rescuers that are based in Klang Valley, Malaysia. from September 1 to November 18, 2023.

#### 3.2 Sample size and sampling method

The study population was estimated at 9 million people, including all races in Klang Valley, Malaysia in 2022 (*Klang Valley*, 2023). The sample size was determined based on the power calculation using the Z formula. It was estimated that a minimum of 385 participants should be sampled to gain a 95% confidence level, with a maximum allowable difference of 0.05 in detecting the KAP proportions in population. Study subjects recruited using simple random sampling methods.

Sample size, n =

$$\frac{N * \left[ \frac{Z^2 (1-p)}{e^2} \right]}{[N - 1 + \left( \frac{Z^2 p (1-p)}{e^2} \right)]} \quad (3.1)$$



### **3.3 Inclusion and exclusion criteria**

The study covered pet owners that have an age frame of 18 to 70 years old. The respondents must be residing in Klang Valley, Malaysia at the time of the questionnaire. The respondents must be able to read and write in our national language, Bahasa Malaysia, English or Mandarin. The pet owners must be owning a cat and/or a dog at the time of the questionnaire. Individuals who do not comply with the inclusion criteria will immediately be excluded from the study.

### **3.4 Questionnaire design**

The instrument used in this study was a self-administered questionnaire web-based which consisted of 4 main sections. Section A consisted of socio-demographic questions (e.g., age, gender, salary, educational level) while sections B, C, and D consisted of knowledge, attitude, and practice questions respectively. to evaluate the levels of knowledge, attitude, and practice of pet owners toward chronic kidney disease in dogs and cats. The design of the knowledge section domain to test the understanding of pet owners on the etiology, clinical signs, diagnosis, and treatment of kidney disease as well as the normal function of kidneys.

Twenty multichotomous questions (“Yes”, “No”, “Not sure”) were prepared to assess their knowledge. Each response of “Yes” will be given a score of 1, while a score of 0 will be given for those who choose “No” or “Not sure”. The pet owners’ level of knowledge will be graded into poor, moderate, or good. Respondents with scores of 1-7, 8-14, and 15-20 were considered to have a poor, moderate, and good level of knowledge, respectively.

In addition, thirteen questions with a five-point Likert scale (“Strongly Agree”, “Agree”, “Neutral”, “Disagree”, and “Strongly disagree”) were prepared to measure the



owner's attitude towards this disease. The response will be scored with those chosen "strongly disagree" given score 1, "disagree" with score 2, "neutral" with score 3, "strongly agree" with score 4, and "agree" with score 5. The total attitude score will be summed up with a maximum score of 65. Respondents with a score of 1- 20 will be considered to have a poor attitude, a score of 21-45 to have a moderate attitude, and a score of 46-65 to have a good attitude.

Finally, the practice domain comprised eight questions with a five-point Likert-scale ("Never", "Rarely", "Sometimes", "Often", and "Always") to evaluate owners' practice. The response will be the score who answered "never" with a score of 1, "rarely" with a score of 2, "sometimes" with a score of 3, "often" with a score of 4, and "always" with having score of 5. The total practice scores have a maximum score of 40 and respondents with scores 1- 10 consider exercise poor practices, scores 11- 25 having moderate practices, and scores 26-40 implementing good practices.

### **3.5 Validity and Reliability**

This study was translated into Malay and Mandarin language and was checked for content validation by two veterinarian lecturers. A pre-testing study was conducted before the study with 18 respondents with similar criteria. Reliability testing conducted using Cronbach's alpha on KAP sections revealed that a measurement of more than 0.7 indicated an acceptable internal consistency reliability.

### 3.6 Statistical Analysis of Data

The data collected were analysed using IBM® SPSS® Version 27 (IBM®, USA). The categorical variables were illustrated using descriptive statistics for frequency and percentage. Pearson Chi-square was used to determine the association between the categorical variables. A p-value of  $\leq 0.05$  was considered significant. When the assumption of the Pearson Chi-square test was not fulfilled, the Fisher Exact test was applied. Spearman's rho correlation was performed to measure the correlation between total scores of knowledge, attitude, and practice. The correlation was significant at a level of  $\leq 0.05$ .

## CHAPTER 4

### RESULT

#### 4.1 Socio-demographic characteristics of respondents

A total of 111 participants were recruited. The majority were female ( $n = 77/111$ , 69.4%), between the age of 1- 30 years old ( $n = 70/111$ , 63.1%), and having income between Rm2500- RM5000 ( $n = 37/111$ , 33.3%). Most respondents have a college or university education level ( $n = 94/111$ , 84.7%) and own at least a dog and/ or a cat ( $n = 91/111$ , 82%). Most participants own pets with a breed ( $n = 106/111$ , 95.5%) that are not predisposed to CKD. Many participants also own pets with age older than 5 years which are mostly predisposed to CKD ( $n = 58/111$ , 52.3%). Besides that, many pet owners managed their pets indoors for both dogs ( $n = 37/111$ , 33.3%) and cats ( $n = 32/111$ , 28.8%). Ninety- five percent ( $n = 106/111$ ) pet owners state that their pet was not diagnosed and treated with CKD.

Table 4.1 Respondents' socio-demographic characteristics (*n* = 111)

Socio-demographic characteristic	Total ( <i>n</i> = 111)	
	<i>n</i>	%
<b>Age (year)</b>		
18 – 30	<b>70</b>	<b>63.1</b>
31 – 60	34	30.6
61 - >65	7	6.3
<b>Gender</b>		
Female	<b>77</b>	<b>69.4</b>
Male	34	30.6
<b>Salary/ Income</b>		
< RM 2500	20	18.0
RM 2500 -RM 5000	<b>37</b>	<b>33.3</b>
RM 5000 – RM 8000	13	11.7
> RM 8000	13	11.7
None	28	25.2
<b>Education level</b>		
Primary	0	0
Secondary	17	15.3
College/ University	<b>94</b>	<b>84.7</b>
<b>Number of pet-owned (dog and/ or cat)</b>		
1 - 3	<b>91</b>	<b>82.0</b>
4 – 6	15	13.5
>6	5	4.5
<b>Breed (dog and/ or cat)</b>		
Predisposed breed	5	4.5
Non- predisposed breed	<b>106</b>	<b>95.5</b>
<b>Pets' Age (dog and/ or cat)</b>		
Predisposed age	<b>58</b>	<b>52.3</b>
Non- predisposed age	53	47.7
<b>Management of Dog</b>		
Indoor	<b>37</b>	<b>33.3</b>
Outdoor	14	12.6
Semi- indoor	17	15.3
Not related	43	38.7
<b>Management of Cat</b>		
Indoor	<b>32</b>	<b>28.8</b>
Outdoor	9	8.1
Semi- indoor	17	15.3
Not related	53	47.7
<b>Is your pet diagnosed with CKD?</b>		
Yes	5	4.5
No/ Unsure	<b>106</b>	<b>95.5</b>
<b>If yes, is your pet being treated for CKD?</b>		
Yes	5	4.5
No/ Not related	<b>106</b>	<b>95.5</b>

## 4.2 Knowledge of CKD in dogs and cats by pet owners

Table 4.2 provides frequencies and percentages of responses on each scale's 20 statements. Most of the participants have heard about CKD ( $n = 72/111$ , 34.1%) and learned about it from veterinarians, books or journals, and websites ( $n = 77/111$ , 69.4%). Most pet owners do understand the function of the kidney is to remove waste products through urination ( $n = 104/111$ , 93.7%) and regulating blood pressure ( $n = 81/111$ , 73%). They also agree that CKD can be caused by aging ( $n = 91/111$ , 82%), bacterial infection ( $n = 69/111$ , 62.2%), viral infection ( $n = 60/111$ , 54.1%), toxicity ( $n = 68/111$ , 61.3%), and improper nutrition ( $n = 77/111$ , 69.4%). Generally, the majority of pet owners lack knowledge of the possible clinical symptoms shown by pets with CKD ( $n = 101/111$ , 91%). Seventy percent ( $n = 78/111$ ) of pet owners are aware of the importance of regular checkups to assess the disease progression and slow down CKD. However, most pet owners are unaware of specific diets formulated to help with CKD ( $n = 62/111$ , 55.9%).

Furthermore, eighty-three percent of pet owners ( $n = 93/111$ ) are aware that keeping their pets hydrated helps the kidneys to stay healthy. Most pet owners ( $n = 85/111$ , 76.6%) were unaware of the standard treatment guidelines for CKD. Most pet owners disagree that anti-vomiting ( $n = 69/111$ , 62.2%), subcutaneous fluid injection ( $n = 62/111$ , 55.9%), anti-anaemia ( $n = 75/111$ , 67.6%), antihypertensive ( $n = 67/111$ , 60.4%) and phosphate binder ( $n = 70/111$ , 63.1%) are unable to help their pets who suffering from CKD. In contrast, more than half of pet owners have correctly chosen "antibiotics" ( $n = 58/111$ , 52.3%) are not a treatment for pets suffering from CKD.

Table 4.2 Knowledge of CKD in dogs and cats by pet owners ( $n=111$ )

Knowledge-based item	Total ( $n = 111$ )			
	Yes		No	
	<i>n</i>	%	<i>n</i>	%
Q1: Have you heard of CKD?	<b>72</b>	<b>64.9</b>	39	35.1
Q2: Where did you learn about CKD?	<b>77</b>	<b>69.4</b>	34	30.6
Q3: I understand a kidney function to remove waste products through urination.	<b>104</b>	<b>93.7</b>	7	6.3
Q4: I understand a kidney has an important role in regulating blood pressure.	<b>81</b>	<b>73.0</b>	30	21.0
Q5: Can aging lead to a reduction of kidney function?	<b>91</b>	<b>82.0</b>	20	18.0
Q6: Can bacterial infection cause CKD?	<b>69</b>	<b>62.2</b>	42	37.8
Q7: Can viral infection cause CKD?	<b>60</b>	<b>54.1</b>	51	45.9
Q8: Can toxicity cause CKD?	<b>68</b>	<b>61.3</b>	43	38.7
Q9: Can improper nutrition cause CKD?	<b>77</b>	<b>69.4</b>	34	30.6
Q10: Which of the following are symptoms of CKD?	10	9.0	<b>101</b>	<b>91.0</b>
Q11: Are you aware of the importance of regular checkups to assess disease progression and slow down CKD?	<b>78</b>	<b>70.3</b>	33	29.7
Q12: Are you aware of specific diets formulated to help with CKD?	49	44.1	<b>62</b>	<b>55.9</b>
Q13: Are you aware that keeping your pet hydrated helps the kidneys stay healthy?	<b>93</b>	<b>83.8</b>	18	16.2
Q14: Do you know any standard treatment guideline for pet suffering CKD?	26	23.4	<b>85</b>	<b>76.6</b>
Q15 -20: Which of the following treatments may help my dogs or cats suffering from CKD?				
Antibiotics	53	47.7	<b>58</b>	<b>52.3</b>
Anti- vomiting	42	37.8	<b>69</b>	<b>62.2</b>
Subcutaneous fluid	49	44.1	<b>62</b>	<b>55.9</b>
Anti- anaemic (Treatment for anemia)	36	32.4	<b>75</b>	<b>67.6</b>
Antihypertensive (Blood pressure lowering drugs)	44	39.6	<b>67</b>	<b>60.4</b>
Phosphate Binders (Phosphate Reducing)	41	36.9	<b>70</b>	<b>63.1</b>

Figure 4.1 tabulated the frequency of each clinical sign which pet owners consider is possible to be the symptoms of CKD. Weight loss ( $n = 84/111$ ), increased urination ( $n = 75/111$ ) and inactive ( $n = 72/111$ ) are the top three of most chosen clinical signs.

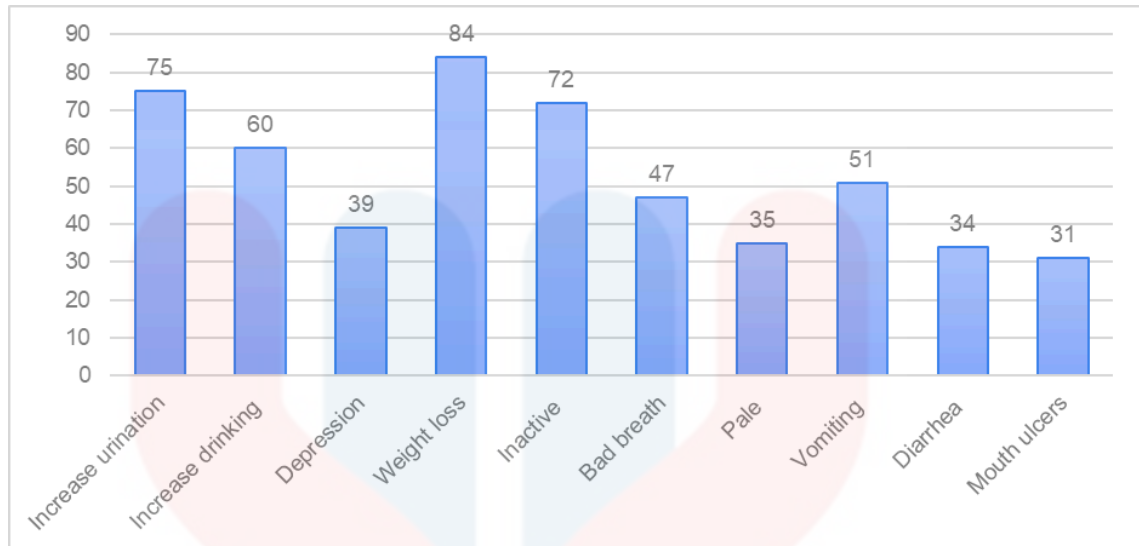


Figure 4.1 Total response from respondents for each clinical sign.

#### 4.3 Attitude on CKD in dogs and cats by pet owners

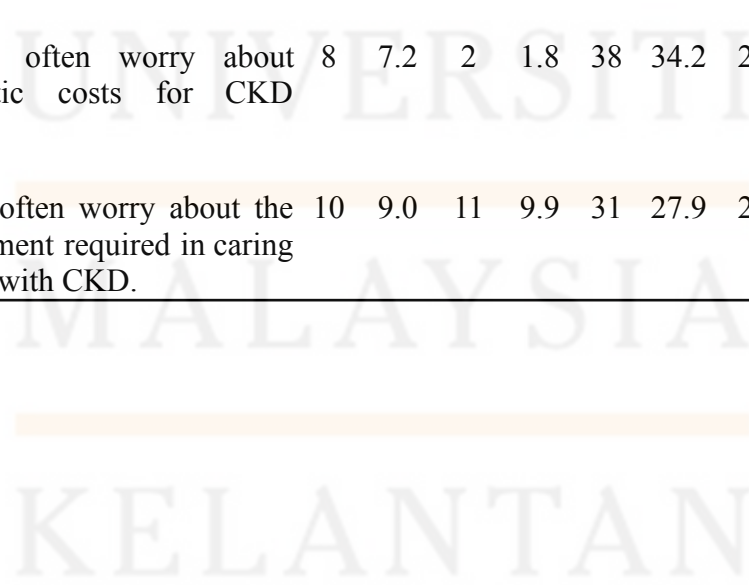
Table 4.3 provides frequencies and percentages of responses on each scale's thirteen statements. Generally, most participants agreed their pet appeared depressed ( $n = 45/111$ , 40.5%) had concerned them with their pet being diagnosed with CKD. Thirty-eight respondents out of one hundred eleven have neutral thoughts if their pet appears to have increased drinking behaviour (34.2%). However, some respondents have neutral thoughts, and some agreed to be worried if their pet has bad breath ( $n = 35/111$ , 31.5%). Furthermore, thirty-four respondents out of one hundred eleven strongly agreed that mouth ulcer (30.6%) is a concern to pet owners if their pet is diagnosed with CKD.

However, the majority of the respondents strongly agreed that they are concerned about the treatment cost ( $n = 47/111$ , 42.3%), diagnostic cost ( $n = 40/111$ , 36%), and commitment required in caring for CKD patients ( $n = 37/111$ , 33.3%).



Table 4.3 Attitude on CKD in dogs and cats by pet owners (*n*=111)

Attitude-based items	Total Scale ( <i>n</i> = 111)									
	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Q1-10: If your pet is diagnosed with CKD, are there any clinical signs that worry you?										
Increase urination	10	9.0	6	5.4	27	24.3	<b>43</b>	<b>38.7</b>	25	22.5
Increase drinking	8	7.2	8	7.2	<b>38</b>	<b>34.2</b>	34	30.6	23	20.7
Bad breath	9	8.1	7	6.3	<b>35</b>	<b>31.5</b>	<b>35</b>	<b>31.5</b>	25	22.5
Weight loss	10	9.0	4	3.6	16	14.4	<b>42</b>	<b>37.8</b>	39	35.1
Pale	7	6.3	4	3.6	30	27.0	<b>38</b>	<b>34.2</b>	32	28.8
Inactive	9	8.1	3	2.7	21	18.9	<b>40</b>	<b>36.0</b>	38	34.2
Depression	7	6.3	7	6.3	20	18.0	<b>45</b>	<b>40.5</b>	32	28.8
Vomiting	7	6.3	6	5.4	23	20.7	<b>40</b>	<b>36.0</b>	35	31.5
Diarrhea	6	5.4	8	7.2	32	28.8	<b>34</b>	<b>30.6</b>	31	27.9
Mouth ulcer	9	8.1	5	4.5	30	27.0	33	29.7	<b>34</b>	<b>30.6</b>
Q11: I often worry about treatment costs for CKD patients.	6	5.4	7	6.3	27	24.3	24	21.6	<b>47</b>	<b>42.3</b>
Q12: I often worry about diagnostic costs for CKD patients.	8	7.2	2	1.8	38	34.2	23	20.7	<b>40</b>	<b>36.0</b>
Q13: I often worry about the commitment required in caring for pets with CKD.	10	9.0	11	9.9	31	27.9	22	19.8	<b>37</b>	<b>33.3</b>





#### 4.4 Practice on CKD in dogs and cats by pet owners

Table 4.4 provides frequencies and percentages of responses to all eight questions. Thirty-seven (33.3%) out of one hundred eleven respondents mention that they will sometimes bring their pet to a clinic for a full health check-up. Forty (36%) out of one hundred eleven respondents also stated that they would sometimes request to run a full blood test whenever they brought their pet to a clinic. However, thirty-seven (33.3%) out of one hundred eleven respondents stated that they would never request to get urinalysis and forty- nine (44.1%) out of one hundred eleven respondents responded that they never requested to get a kidney ultrasound imaging for their pets during their visit in a vet clinic. Most participants have practiced to always listen to veterinarian's advice (n =46/111, 41.4%) and comply with the treatment regime (n =49/111, 44.1%) prescribed by the veterinarian for their sick animal.

Besides that, thirty- two (28.8%) out of one hundred eleven respondents responded they sometimes do prefer to provide a home- cooked diet and fifty- two (46.8%) out of one hundred eleven respondents always prefer to have a prescription diet for their CKD patients.

Table 4.4 Practice on CKD in dogs and cats by pet owners ( $n=111$ )

Practice-based items	Total Scale ( $n = 111$ )									
	Never		Rarely		Sometimes		Often		Always	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Q1: How frequent would you bring your pets to a clinic for a full health check-up?	14	12.6	22	19.8	<b>37</b>	<b>33.3</b>	23	20.7	15	13.5
Q2: How frequent would you request to run a full blood test (complete blood count and serum biochemistry test)?	25	22.5	27	24.3	<b>40</b>	<b>36.0</b>	13	11.7	6	5.4
Q3: How frequently would you request to get urinalysis?	<b>37</b>	<b>33.3</b>	25	22.5	36	32.4	9	8.1	4	3.6
Q4: How frequently would you request to get a kidney ultrasound imaging for your pet?	<b>49</b>	<b>44.1</b>	28	25.2	25	22.5	5	4.5	4	3.6
Q5: How often would you listen to the advice given by your veterinarian?	3	2.7	9	8.1	21	18.9	32	28.8	<b>46</b>	<b>41.4</b>
Q6: How often do you comply with the treatment regime for your sick pets?	4	3.6	7	6.3	19	17.1	32	28.8	<b>49</b>	<b>44.1</b>
Q7-8: I would prefer _____ provided for my pet that has been diagnosed with CKD.										
Home-cooked	14	12.6	10	<b>9.0</b>	<b>32</b>	<b>28.8</b>	29	26.1	26	23.4
Prescription diet for CKD	6	5.4	6	5.4	14	12.6	33	29.7	<b>52</b>	<b>46.8</b>

#### 4.5 Respondent's level of knowledge, attitude, and practice towards CKD in dogs and cats

Data from these three domains were analyzed descriptively and presented by using frequency and percentages. Table 4.5 shows three indicators of poor, moderate, and good levels of respondents' knowledge, attitude, and practices. The results revealed that most respondents in this study have a moderate level of knowledge ( $n = 61/111$ , 55%), attitude ( $n = 55/111$ , 49.5%), and practices ( $n = 69/111$ , 62.2%) towards CKD in dogs and cats.

Table 4.5 Respondent's level of knowledge, attitude, and practice (KAP) towards CKD in dogs and cats ( $n=111$ )

Variables	Level	Score	<i>n</i> (%)
Knowledge	Poor	1 – 7	12 (10.8)
	Moderate	8 – 14	<b>61 (55.0)</b>
	Good	15 – 20	38 (34.2)
Attitude	Poor	1 – 20	6 (5.4)
	Moderate	21 – 45	<b>55 (49.5)</b>
	Good	46 – 65	50 (45.0)
Practice	Poor	1 – 10	0 (0)
	Moderate	11 – 25	<b>69 (62.2)</b>
	Good	26 – 40	42 (37.8)

#### **4.6 Association between respondents' selected socio-demographic characteristics and Knowledge, Attitude, and Practice of CKD in dogs and cats**

In Table 4.6, the result indicated that there were significant associations between education level with knowledge ( $p = 0.024$ ), management of a dog with knowledge ( $p = 0.040$ ), having a pet that was diagnosed with CKD, and knowledge ( $p = 0.028$ ), and if the pet received CKD treatment with knowledge ( $p = 0.028$ ). There were more respondents with the highest academic level of college or university level with moderate knowledge. The results also showed a higher percentage of participants who manage their dogs indoors have poor knowledge. Most participants with pets diagnosed with CKD and received treatment have moderate knowledge.

Results in Table 4.7 showed that there was a significant association between gender with attitude ( $p = 0.047$ ), education level with attitude ( $p = 0.021$ ), and number of pets owned with attitude ( $p = 0.021$ ). Most respondents are female and contained college or university academic level with showing good attitude towards CKD in dogs and cats. Respondents with fewer pets- owned (1-3 pets) showed a majority of having moderate attitudes towards CKD in dogs and cats.

Table 4.6 Association between selected socio-demographic characteristics and Knowledge of CKD in dogs and cats

Variables	Grades <i>n</i> (%)			Fisher Exact test ( <i>df</i> )	<i>p</i> - value
	Poor	Moderate	Good		
<b>Education level</b>				7.248 (2)	0.024*
Primary	0 (0)	0	0		
High school	9 (8)	6 (5)	2 (2)		
College/ University	19 (17)	<b>49 (44)</b>	26 (23)		
NONE	0 (0)	0	0		
<b>Management of Dog</b>				12.832 (6)	0.040*
Indoor	15 (14)	12 (11)	10 (9)		
Outdoor	3 (3)	7 (6)	4 (4)		
Semi- indoor	3 (3)	13 (12)	1 (1)		
Not related	7 (6)	<b>23 (21)</b>	13 (12)		
<b>Pet diagnosed with CKD</b>				6.123 (2)	0.028*
Yes	0 (0)	1 (1)	4 (4)		
No/ Unsure	28 (25)	<b>54 (49)</b>	24 (22)		
<b>If yes, is it receiving treatment?</b>				6.123 (2)	0.028*
Yes	0 (0)	1 (1)	4 (4)		
No/ Unrelated	28 (25)	<b>54 (49)</b>	24 (22)		

\**p*- value of <0.05 is statistically significant

Table 4.7 Association between selected socio-demographic characteristics and Attitude towards CKD in dogs and cats

Variables	Grades <i>n</i> (%)			Fisher Exact test ( <i>df</i> )	<i>p</i> - value
	Poor	Moderate	Good		
<b>Gender</b>				5.544 (2)	0.047*
Male	4 (4)	19 (17)	11 (10)		
Female	2 (2)	36 (32)	<b>39 (35)</b>		
<b>Education level</b>				7.143 (2)	0.021*
Primary	0 (0)	0 (0)	0 (0)		
High school	2 (2)	12 (11)	3 (3)		
College/ University	4 (4)	43 (39)	<b>47 (42)</b>		
NONE	0 (0)	0 (0)	0 (0)		
<b>Number of pet-owned</b>				10.350 (4)	0.021*
1-3	5 (5)	<b>49 (44)</b>	37 (33)		
4-6	0 (0)	3 (3)	12 (11)		
>6	1 (1)	3 (3)	1 (1)		

\**p*- value of <0.05 is statistically significant

#### 4.7 Correlation between total knowledge, attitude, and practice score of CKD in dogs and cats

From Table 4.8 there is a weak positive correlation between total knowledge score with total attitude score ( $r = 0.190$ ) and total practice score ( $r = 0.069$ ), as well as between total attitude score and total practice score ( $r = 0.0142$ ). However, only the correlation between total knowledge and attitude score was significant in this study ( $p$ -value = 0.045).

Table 4.8 Correlation between total knowledge, attitude, and practice score

Spearman's rho Correlations	TKS ( $p$ - value)	TAS ( $p$ - value)	TPS ( $p$ - value)
TKS	1.000	0.190 (0.045*)	0.069 (0.472)
TAS	0.190 (0.045*)	1.000	0.142 (0.138)
TPS	0.069 (0.472)	0.142 (0.138)	1.000

TKS: Total Knowledge score, TAS: Total Attitude score, TPS: Total Practice score

\*Correlation is significant at the 0.05 level

## CHAPTER 5

### DISCUSSION

The study conducted in Klang Valley, Malaysia, evaluated pet owners' knowledge, attitudes, and practices regarding chronic kidney disease (CKD) in dogs and cats. Overall, participants showed moderate knowledge about CKD, understanding crucial aspects such as kidney functions, risk factors, clinical signs, and the significance of diagnosis. The majority of respondents obtained information about CKD from reliable sources like books, websites, and veterinarians, rather than from friends who had experience with CKD pets. Research suggests that while pet owners prefer information from veterinarians, many also seek supplemental information online, expecting veterinarians to guide them on online content (Lai et al., 2021). Additionally, there's a perception among pet owners that CKD in humans shares similarities with CKD in pets (Chacar et al., 2020), contributing to their understanding of the disease in their animals.

The lack of awareness among most respondents regarding the availability of specialized diets and standard treatment guidelines for CKD patients affects their responses to questions about treatment. Special pet diets such as Royal Canin renal diet are specially made for pets with diagnosed renal disease. Thus, it may not be as heavily marketed or promoted as general pet foods, leading to lower awareness among pet owners. Besides that, some pet owners may not realize the severity of their pet's renal issues or may not observe noticeable symptoms, leading to a lack of motivation to seek out specialized diets. Additionally, most respondents have not owned a pet diagnosed



with CKD, which may impact their understanding of the disease and its proper management.

Furthermore, the study found that the majority of respondents had moderate attitudes towards CKD in dogs and cats. They expressed concern about their pets if any clinical signs of CKD were present, considering their pets as integral members of the family (Wiltzius et al., 2018). Pet owners prioritize their pets' health similarly to their own well-being (Dunn, 2022). However, they also strongly acknowledged concerns about the financial implications associated with diagnostic and therapeutic costs and the commitment required for caring for pets with CKD. Similar challenges have been observed in studies conducted in developed countries, where some pet owners face financial constraints in affording pet care (American Veterinary Medical Association, 2022). This barrier to seeking veterinary care is particularly prominent among lower to middle-income groups of respondents (Wiltzius et al., 2018).

In addition to moderate knowledge and attitudes, study participants demonstrated moderate practices regarding CKD in dogs and cats. Many pet owners infrequently bring their pets to the clinic for comprehensive health check-ups, including complete blood tests and serum biochemistry testing. Furthermore, a significant number of pet owners indicated they had never requested a veterinarian to perform urinalysis or ultrasonography to assess kidney health in their pets. This lack of proactive monitoring may stem from a lack of awareness regarding the importance of regular check-ups for CKD, especially in the absence of obvious clinical signs in the early stages of the disease (Ford & Mazzaferro, 2012). Concerns about the cost of routine health checks and diagnostic tests may also contribute to delays in diagnosing CKD. In such cases, decisions regarding diagnostic testing often rely on veterinarian recommendations, with limited input from pet owners or upfront discussion about available options (Janke et al., 2021). Therefore, veterinarians play a crucial role in educating pet owners about the



significance of routine check-ups, preventive care, and specific diagnostic tests for conditions like CKD (Evason et al., 2021).

The study revealed a notable correlation between educational attainment and levels of knowledge and attitude, with respondents possessing higher educational levels demonstrating moderate knowledge about CKD in dogs and cats. This finding is consistent with existing research indicating that individuals with higher education levels tend to exhibit greater knowledge and attitudes toward the prevention and early detection of chronic kidney disease (Teklezgi et al., 2023).

The socio-demographic characteristics related to dog management showed a significant association with knowledge levels, with the majority of respondents selecting "not related" indicating they only owned cats, not dogs. Many of these respondents have elderly cats over twelve years old, placing them at risk for chronic kidney disease (CKD), which is more common in older cats compared to dogs (Rowe, 2019). This higher awareness among cat owners may contribute to their knowledge about CKD. Additionally, pet owners who do not currently have pets diagnosed with CKD and undergoing treatment also demonstrated significant associations with knowledge levels. Despite their pets not being affected by the disease, some owners may proactively seek additional information about potential health issues common in older pets. Previous research has shown that a considerable number of pet owners utilize the internet to search for pet health information (Kogan et al., 2009). Moreover, some pet owners may have acquired knowledge about CKD from past experiences with pets diagnosed with the disease, highlighting the role of firsthand experiences in generating understanding and awareness of diseases (Passarelli & Kolb, 2011).

Apart from that, the current study shows a significant association between gender and attitude. The current study indicates that the majority of respondents exhibiting a positive attitude are female, aligning with the predominant female

participation in the study. Females tend to prioritise health concerns more significantly than males leading to a higher proportion of female participants. A study supported with reporting females are more proactive and engaged in seeking, gaining, and discussing health-related information (Ek, 2013). Besides that, the current data is supported by a study stating that the female gender might have poor knowledge but good attitude (Yusoff *et al.*, 2016). Females are always more concerned about health-related issues which makes them show better attitudes towards the disease.

This study shows a positive significant correlation between total knowledge and attitude score which indicates pet owners with higher knowledge levels of CKD in dogs and cats have a better attitude towards the disease. A finding from a study carried out by Tharu *et al.* (2022) stated that a positive correlation existed between caregivers' knowledge and attitude ( $r = 0.30, p < 0.01$ ). It revealed that caregivers who had higher education demonstrated positive attitudes. Thus, knowledge has an impact on the caregiver's attitude development. According to a current study, most pet owners are mostly educated with a moderate level of knowledge towards the disease.

## CHAPTER 6

### CONCLUSION & RECOMMENDATION

While the study successfully evaluated pet owners' knowledge, attitudes, and practices towards CKD in dogs and cats, the results indicate that most pet owners possess only moderate levels of knowledge, attitude, and practices. Many respondents have incorrect information regarding clinical signs exhibited by their pets, lack awareness of specialized renal diets, and do not understand standard treatment guidelines and diagnostic evaluations for early CKD detection.

To address these gaps, educational campaigns should be promoted through various channels such as social media, websites, brochures, and posters. These campaigns should provide accurate, easily understandable information about CKD symptoms, causes, treatment options, and diagnostic evaluations. Collaboration between veterinarians should be encouraged to conduct workshops, webinars, or seminars aimed at educating pet owners about CKD management. Veterinarians play a crucial role in explaining the importance of regular check-ups and preventive measures to pet owners. Additionally, veterinarians should address concerns about veterinary costs by educating and increasing awareness among clients about the value of veterinary care.

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## APPENDIX A

Association between selected socio-demographic characteristics and Practice towards CKD in dogs and cats

Variables	Grades <i>n</i> (%)		Fisher Exact test ( <i>df</i> )	<i>p</i> - value
	Moderate	Good		
<b>Age</b>			3.622 (2)	0.156
18-30	<b>48 (43)</b>	22 (20)		
31-60	18 (16)	16 (14)		
>61	3 (3)	4 (4)		
<b>Gender</b>			0.003 (1)	1.000
Male	21 (19)	13 (12)		
Female	<b>48 (43)</b>	29 (26)		
<b>Salary/ Income</b>			3.377 (4)	0.506
<RM2500	15 (14)	5 (5)		
RM2500- RM5000	<b>24 (22)</b>	13 (12)		
RM5000- RM8000	7 (6)	6 (5)		
>RM8000	6 (5)	7 (6)		
NONE	17 (15)	11 (10)		
<b>Education level</b>			0.094 (1)	0.479
Primary	0 (0)	0 (0)		
High school	10 (9)	7 (6)		
College/ University	<b>59 (53)</b>	35 (32)		
NONE	0 (0)	0 (0)		
<b>Number of pet-owned</b>			0.635 (2)	0.848
1-3	<b>56 (50)</b>	35 (32)		
4-6	9 (8)	6 (5)		
>6	4 (4)	1 (1)		
<b>Pet breed</b>			0.775 (1)	0.371
Predisposed	4 (4)	1 (1)		
Non- predisposed	<b>65 (59)</b>	41 (37)		
<b>Pet age</b>			2.396 (1)	0.088
Predisposed	<b>40 (36)</b>	18 (16)		
Non- predisposed	29 (26)	24 (22)		
<b>Management of Dog</b>			1.109 (3)	0.796
Indoor	24 (22)	13 (12)		
Outdoor	7 (6)	7 (6)		
Semi- indoor	11 (10)	6 (5)		
Not related	<b>27 (24)</b>	16 (14)		
<b>Management of Cat</b>			3.241 (3)	0.371
Indoor	18 (16)	14 (13)		
Outdoor	8 (7)	1 (1)		
Semi- indoor	10 (9)	7 (6)		
Not related	<b>33 (30)</b>	20 (18)		
<b>Pet diagnosed with CKD</b>			1.052 (1)	0.277

Yes	2 (2)	3 (3)		
No/ Unsure	<b>67 (60)</b>	39 (35)		
<b>If yes, is it receiving treatment?</b>			1.052 (1)	0.277
Yes	2 (2)	3 (3)		
No/ Unrelated	<b>67 (60)</b>	39 (35)		

*\*p- value of <0.05 is statistically significant*



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