Syopses of clinical studies supporting use of Hill’s® Prescription Diet® c/d®, s/d®, u/d® and x/d® formulas


Researchers surgically transplanted sterile struvite urooliths into the urinary bladders of 24 adult female beagles; they then divided the dogs into four groups (A, B, C, D) of six dogs each. Two additional dogs without bladder stones served as controls (group E). Urolithiasis was associated with urinary tract infection (UTI) in groups A and B; dogs in groups C and D had sterile struvite urolithiasis. Researchers fed dogs in groups A and C a calculolytic food (s/d® Canine prototype); groups B and D dogs consumed an adult maintenance food. The two control dogs without bladder stones also received the maintenance food. Of all dogs with struvite urolithiasis, those consuming s/d® Canine therapeutic food showed significant improvement compared to those consuming the adult maintenance food. For all six dogs having urolithiasis without UTI, stones dissolved rapidly (average time for dissolution—3.3 weeks). Of the dogs with concurrent urinary tract infection, complete stone dissolution occurred in 5 of 6 dogs, even without antibiotic therapy. The bladder stone in the sixth dog decreased to 1/5 its original size. Dogs consuming the adult maintenance food didn’t do as well. After six months, those with concurrent urinary tract infections had bladder stones that were five times larger and 14 times heavier than at the beginning of the study. Stones eventually dissolved in 4 of 6 dogs without concurrent UTI, taking an average of 14 weeks. Foods designed to reduce the urine concentration of urea, phosphorus and magnesium aid in the dissolution of struvite uroliths in dogs.


In a long-term feeding study conducted at Hill’s Pet Nutrition Center, a group of 10 normal cats were fed Hill’s® Prescription Diet® c/d® Feline dry food for two years. Urinalyses with urine sediment examinations, serum chemistry panels, complete blood counts, and venous blood gas determinations were evaluated every two months. During the two-year period, cats exhibited no clinical signs of lower urinary tract disease. Urinalyses showed acidic urine and normal urine sediment, with no clinically significant struvite or calcium oxalate crystalluria. Venous blood gas determinations were normal.


An English cocker spaniel with a history of recurrent sterile struvite urolithiasis sired two male offspring, each of which had three separate episodes of sterile struvite urolithiasis. In each case, bladder stones dissolved one to two months after the dogs began eating exclusively Hill’s® Prescription Diet® s/d® Canine therapeutic food. As early as six months after returning to their previous adult maintenance food, the dogs were again diagnosed with sterile struvite uroliths. When fed exclusively to dogs with sterile struvite urooliths, s/d® Canine therapeutic food can aid in dissolution of these stones within one or two months.


Activity product ratios (APR) and relative supersaturation (RSS) are urine tests that help assess potential for formation or dissolution of urinary crystals or stones. The author measured struvite APR in urine from cats consuming several products including c/d® Feline and s/d® Feline dry formulas. Struvite APR for c/d® Feline and s/d® Feline were 0.6 and 0.55 respectively. A struvite APR less than one suggests conditions in the urine are unfavorable for struvite crystal and stone formation.


Urine activity product ratios of uric acid, sodium urate and ammonium urate, and urinary excretion of metabolites were determined in 24-hour samples produced by six healthy beagle dogs during periods of consumption of a low-protein, casein-based food and a high-protein, meat-based food. Consumption of the low-protein food revealed: lower activity product ratios of uric acid, sodium urate and ammonium urate; lower 24-hour urinary excretion of uric acid, ammonia, sodium, calcium, phosphorus, magnesium and oxalic acid; higher 24-hour urine pH; and lower endogenous creatinine clearance. The results suggest that Hill’s® Prescription Diet® u/d® Canine food can be used to successfully manage ammonium urate, other purine and calcium oxalate uroliths in dogs.


Excretion of metabolites, volume and pH were determined in 24-hour urine samples produced by six healthy beagle dogs during periods of allopurinol administration and consumption of a 10.4% protein (dry matter), casein-based food and a 31.4% protein (dry matter), meat-based food. Compared to when the high-protein, meat-based food was fed, consumption of the low-protein, casein-based food revealed: lower values of uric acid, xanthine, ammonia, net acid, titratable acid and creatinine excreted during a 24-hour period; lower concentrations of plasma uric acid, xanthine and urea nitrogen; and higher urine pH values, urine volumes, and urine bicarbonate values. Use of u/d® Canine food and allopurinol in protocols designed for dissolution of ammonium urate and other purine uroliths may be beneficial in preventing hyperxanthinuria and xanthine urolith formation in dogs.

Urine activity product ratios of uric acid, sodium urate and ammonium urate, and urinary excretion of 10 metabolites were determined in 24-hour urine samples produced by six healthy beagle dogs during periods of consumption of four moist foods containing approximately 11% protein (dry weight) and various protein sources: casein-based, egg-based, chicken-based and chicken-based, liver-flavored foods. Results showed that use of moist foods containing approximately 10.5% protein (dry weight) in protocols designed for dissolution and prevention of urate uroliths may be beneficial. The source of dietary protein in such foods did not significantly influence the saturation of urine with uric acid, sodium urate or ammonium urate. The results suggest that u/d® Canine therapeutic food can be used to successfully manage ammonium urate and other purine uroliths in dogs.


Four commercial foods (Hill’s® Prescription Diet® p/d® Canine wet, k/d® Canine wet, u/d® Canine wet and s/d® Canine wet) were fed to six healthy beagle dogs to evaluate their influence on 24-hour excretions of uric acid, ammonia, net acid, titratable acid, bicarbonate and creatinine in urine; 24-hour urine volumes and urinary pH values; plasma uric acid concentrations; serum creatinine concentration; and endogenous creatinine clearance values. Consumption of u/d® Canine wet food was associated with the lowest plasma uric acid concentration; lowest 24-hour urinary uric acid, ammonia, titratable acid and net acid excretions; lowest endogenous creatinine clearance values; highest 24-hour urinary bicarbonate excretion and urine pH values; and highest 24-hour urine volumes. Consumption of p/d® Canine wet food was associated with opposite results; results of consumption of s/d® Canine and k/d® Canine foods were intermediate between those for u/d® Canine and p/d® Canine foods. Results support use of u/d® Canine formulas for management of ammonium urate and other purine uroliths in dogs.


Activity product ratios of uric acid, sodium urate and ammonium urate were determined in 24-hour urine samples produced by six healthy beagle dogs during periods of consumption of a 10.4% protein (dry matter), casein-based food and a 20.8% protein (dry matter), casein-based food. Dogs consuming the lower protein food revealed: lower activity product ratios of uric acid, sodium urate and ammonium urate; lower 24-hour urinary excretions of ammonia and phosphorus; higher magnesium excretion and urine pH values. These results suggest that u/d® Canine formula can be used successfully in protocols designed for dissolution and prevention of ammonium urate and other purine uroliths in dogs.


Eight adult cats with alkaline urine and struvite crystalluria were divided into two groups. Four cats eating Hill’s® Prescription Diet® s/d® Feline dry and four eating Hill’s® Prescription Diet® s/d® Feline wet therapeutic foods showed progressively less struvite crystalluria beginning with week 3 of treatment. Urine pH for both groups became more acidic starting from the second week. After 13 weeks of treatment, the quantitative reduction in crystalline sediment was significant (over 85%) for both groups. No significant differences in urine pH or amount of crystalluria were observed between the diets throughout the treatment. Both wet and dry forms of s/d® Feline therapeutic formulas effectively aided management of struvite crystalluria.


Sixteen privately owned dogs of various breeds, ages and weights were fed four dry commercial dog foods in Latin Square design: an adult maintenance food (ProPlan® Canine Chicken & Rice Adult), a fiber-enhanced therapeutic food (Purina Veterinary Diets™ Canine DCO-Formula), a therapeutic food for management of renal failure (Purina Veterinary Diets™ Canine NF-Formula) and a therapeutic food for prevention of struvite urolithiasis (Hill’s® Prescription Diet® c/d® Canine). Foods were each fed for 21 days at which time blood and urine samples were obtained. Thirteen dogs completed the study. Serum phosphorus concentrations and urine pH were significantly higher when dogs consumed the renal failure food. A postprandial effect on urine pH was not demonstrated when dogs consumed any food. Acidic urine pH (6.0–6.5) was obtained when dogs consumed c/d® Canine and struvite crystalluria was uncommon. Urine pH can be manipulated in healthy dogs when consuming various foods. Dogs consuming c/d® Canine dry formula produce an acid urine pH and only occasional struvite crystalluria.


Several nutrition-related conditions in cats are discussed. Of special interest is a table linking various levels of dietary magnesium and urinary pH with urinary obstruction in male cats over a period of 40 weeks. None of four cats obstructed while consuming Hill’s® Prescription Diet® c/d® Feline wet food (magnesium concentration = 14 mg/100 kcal, mean fasting urine pH = 6.2) for 40 weeks.
One of four cats obstructed when fed a food with 43 mg/100 kcal of magnesium (mean fasting urine pH = 6.2). Six of eight cats obstructed when fed a food with 94 mg of magnesium/100 kcal (mean fasting urine pH = 6.1). Seven of eight cats obstructed while consuming a food with 121 mg/100 kcal of magnesium (mean fasting urine pH = 6.7). Six of eight cats obstructed when fed food with 147 mg/100 kcal of magnesium (mean fasting urine pH = 5.9).

This study indicates the importance of controlling both urinary pH and dietary magnesium in the management of feline lower urinary tract disease due to struvite crystalluria.


An eight-year-old spayed miniature schnauzer was diagnosed with urinary tract infection and struvite urinary bladder stones. The stones dissolved after eight weeks of treatment with Hill's® Prescription Diet® s/d® Canine therapeutic food and antibiotics. The dog was again presented eight months later with palpable bladder stones. The owner refused further diagnostic workup, and the dog was placed on s/d® Canine food and antibiotics with the assumption that she again had a UTI associated with struvite urolithiasis. Eight weeks later the owner reported the dog had been normal for several weeks. The owner was given a recipe for a homemade food to help prevent struvite cystic calculi. However, the veterinarian radiographed the dog 18 months later and saw radiodense calculi in the urinary bladder. This time, management with s/d® Canine food and antibiotics was unsuccessful in dissolving the bladder stones. After further questioning, the pet owner revealed that when on the homemade food, the dog had also been eating raw vegetables, table scraps, and rhubarb leaves. Rhubarb leaves contain large amounts of soluble oxalates; thus, the bladder stones probably contained calcium oxalate. This case report described how s/d® Canine therapeutic food coupled with antibiotics successfully managed a dog with infection-induced struvite urolithiasis. This case stresses the importance of patient follow-up and of doing a diagnostic workup for each disease episode.


A young adult, castrated male DSH cat was admitted for pollakiuria, hematuria and dysuria. The cat was being fed a commercial dry grocery brand cat food. Radiographs demonstrated multiple radiodense cystic calculi and urinalysis showed hematuria but no crystalluria. A tentative diagnosis of struvite urolithiasis was made. The cat was fed s/d® Feline food exclusively. Clinical signs disappeared within a week and no calculi were visible radiographically within three weeks. s/d® Feline food was continued an additional two weeks. This case study shows that s/d® Feline therapeutic food can be used to successfully manage struvite urolithiasis in cats.


Activity Product Ratio (APR) studies were conducted to provide an objective and rapid means of assessing the effect of dietary changes on the potential to develop crystalluria or urolithiasis in normal cats. An APR test panel consisting of ten adult, spayed cats was selected for each 30-day study. One APR study compared effects of feeding c/d® Feline wet food with a control formula; a second compared c/d® Feline dry food with a control formula. For each study, animals were divided into two groups; five cats were fed c/d® Feline wet (or dry) and five a control food. At two weeks, following a 48-hour urine collection, the cats were switched to the opposite formula for the remainder of the study. Urine was collected over a second 48-hour period. Urine pH and nine biochemical parameters (including calcium, oxalate, citrate, magnesium, and phosphorus) were measured on all urine samples. Results were fed into a computer model that calculated the relative supersaturation (RSS). Then purified “seed crystals” were added to samples of urine and incubated at body temperature for 48 hours. At the end of this period, the biochemical parameters were repeated, and all results were analyzed. If the seed crystal tended to dissolve during incubation, the level of minerals in the urine would now be higher. However, if the presence of the seed crystal stimulated further precipitation of mineral from the urine, the remaining mineral concentration in the urine would be lower. A ratio of the two sets of values (before and after incubation), the Activity Product Ratio, was determined for each type of seed crystal (struvite and calcium oxalate) to predict an overall tendency for the crystals to dissolve (protective effect) or not. Struvite APR for Hill’s® Prescription Diet® c/d® Feline wet and dry formulas were determined to be 0.26 (+/- 0.17) and 0.68 (+/- 0.52) respectively. An APR value measures risk of formation of a specific type of crystal or stone, based upon the purified seed crystal used in the test. In general, lower struvite APR numbers mean less likelihood of struvite crystal or stone formation. Furthermore, struvite APR values less than one indicate the likelihood of struvite stone dissolution. Struvite APR for c/d® Feline wet and dry formulas were 0.26 (+/- 0.17) and 0.68 (+/- 0.52) respectively. These low APR values mean c/d® Feline wet and dry formulas are effective aides in the management of cats with struvite FLUTD.


Infection-induced struvite urinary bladder stones and a vesicourachal diverticulum affecting a nine-week-old male mixed breed dog were eliminated with the aid of s/d® Canine therapeutic food and antibiotic treatment. The bladder stones dissolved within nine days of initiating treatment. As soon as stone dissolution was complete, the puppy was placed on a premium brand puppy food; antibiotics were continued for several more weeks. The diverticulum disappeared after a few more weeks of antibiotics. Although not intended for use in puppies, short-term use of s/d® Canine therapeutic dog food with concurrent antibiotic therapy, can be used...
to effectively manage puppies with infection-induced struvite urinary bladder stones. Bladder stones in this case dissolved within nine days of starting treatment.


Ten cats with uroliths composed of 100% calcium oxalate were evaluated. Cats were 7.7 ± 4.7 years old and hypercalcemia, renal failure, bacterial urinary tract infection or uroliths were not detected in any cat at the time of the study. Cats were excluded if they received glucocorticoids or calcium supplements within the past two years. To minimize differences attributable to individual cats or time, a crossover design was used to evaluate the effect of food on urine APR for calcium oxalate. Two groups of foods were evaluated; 1) a wet food formulated to prevent CaOx urolith formation (x/d® Feline) and 2) the foods each cat consumed prior to urolith detection. The order in which food groups were fed to each cat was randomly assigned. Each food was fed to cats for eight weeks prior to evaluation of urine APR. At the end of each 8-week treatment period, cats were hospitalized for a 72-hour urine collection. Urine concentrations of creatinine, sodium, potassium, chloride, calcium, magnesium, phosphorus, oxalic acid and uric acid were determined along with APR for calcium oxalate in urine. APR were calculated by dividing the relative saturation values for CaOx before incubation with calcium oxalate monohydrate seed crystals by the relative saturation values for CaOx after incubation with seed crystals.

When results from the two dietary treatments were compared, mean urine APR values for calcium oxalate were significantly lower during consumption of wet x/d® Feline food. Consumption of wet x/d® Feline food was also associated with significant reductions in 72-hour concentrations of calcium, sodium, potassium and chloride. Significant differences between dietary groups were not detected for 72-hour urine oxalic acid and citric acid concentrations, and urine pH and volume. One cat had calcium oxalate crystals evident on urinalysis during consumption of the urolith-forming food. Crystalluria resolved during consumption of x/d® Feline wet formula.


Eight dogs with calcium oxalate urolithiasis (four miniature poodles, two Lhasa apsos, one Shih Tzu and one Yorkshire terrier) were evaluated to determine whether hydrochlorothiazide (HCTZ) reduces urinary calcium excretion. Each dog was fed a low-calcium, low-protein food (u/d® Canine wet formula) with and without administration of HCTZ and a higher protein adult maintenance food with and without administration of HCTZ. Hydrochlorothiazide significantly decreased urine calcium and potassium concentration and excretion. Compared with the adult maintenance food, u/d® Canine food significantly decreased urine calcium and oxalic acid concentration and excretion. The greatest reduction in urine calcium concentration and excretion was achieved when dogs received HCTZ and u/d® Canine formula. The hypocalciuric effect of HCTZ in conjunction with feeding u/d® Canine food will minimize recurrence of calcium oxalate urolith formation in dogs.


Forty-six client-owned cats with idiopathic cystitis completed a 12-month study to evaluate canned and dry forms of a commercially available acidifying food. The cats were divided into two groups. Eighteen cats were fed the wet acidifying formula, and 28 were fed the dry form. Cats were examined at two weeks, four months, six months, and 12 months; at these times, urinalyses, blood gas analyses, blood counts, and blood chemistry analyses were conducted. Additionally, owners were contacted by phone monthly to obtain progress reports. Sixteen of 18 cats (89%) in the wet group completed the 12-month study without further signs of LUTD compared with 17 of 28 cats (61%) fed the dry formula. Analysis confirmed that the proportion of cats in which clinical signs recur was significantly lower in the wet food group than in the dry group. The primary difference observed in urinalyses comparisons was in specific gravity. Cats fed the wet food produced urine with a significantly lower specific gravity than those fed the dry formula. This study demonstrates the effectiveness of feeding a wet food to aid in the management of idiopathic cystitis in cats.


A four-year-old female beagle with infection-induced struvite urinary bladder stones was successfully treated with antibiotics and s/d® Canine therapeutic food. The stones were dissolved in approximately 2.5 months. The authors stated that this case report was representative of the response to medical treatment they experienced in 10 of 10 additional dogs evaluated and treated for struvite urolithiasis. Feeding s/d® Canine therapeutic food in conjunction with antibiotic therapy is successful in managing dogs with infection-induced struvite urolithiasis.


The authors conducted a year-long prospective clinical study of 30 male cats treated for naturally occurring urethral obstruction caused by matrix-crystalline plugs. Ten cats were managed by perineal urethrostomy (PU), 10 with a calculolytic food similar to wet s/d® Feline food, and 10 with both perineal urethrostomy and the calculolytic formula. During the study period, a significant
number of cats having perineal urethrostomies with or without concomitant dietary management, developed bacterial urinary tract infections (UTIs) compared to cats managed only with dietary modification. Two cats having perineal urethrostomy developed infection-induced struvite uroliths. In the 10 cats managed by PU only, researchers identified struvite crystalluria in 22 out of 49 urine samples. They found struvite crystalluria in 5 out of 50 urine samples collected from cats managed with the calculolytic food only, and they identified struvite crystalluria in 2 of 50 urine samples from cats managed with both PU and calculolytic food. At the time of this study, perineal urethrostomy (PU) was the accepted method for preventing re-obstruction in cats treated for urethral obstruction caused by matrix-crystalline plugs. This study showed how a calculolytic formula, quite similar to wet s/d® Feline formula, could medically manage this condition in cats, and PU surgery was not necessary. All of the above treatments successfully prevented recurrence of urethral obstruction in the cats. However, researchers identified struvite crystalluria less frequently in cats managed with the calculolytic food. Most importantly, cats fed the calculolytic food did not need surgery; therefore they did not acquire frequent urinary tract infections that commonly occur in cats having PU surgery.


Seven cats with struvite uroliths were part of this study on the biological behavior of vesicourachal diverticula in cats. One cat, with a concomitant urinary tract infection, was managed with s/d® Feline food and an antibiotic, and two large urocystoliths dissolved 11 weeks after initiation of therapy. The bladder stones in the six remaining cats dissolved in a mean of five weeks after beginning management with s/d® Feline food. Resolution of each cat’s vesicourachal diverticulum was confirmed at the time of follow-up radiographic studies. Use of s/d® Feline food successfully aided dissolution of struvite uroliths in seven cats.


A 3-year-old male castrated domestic shorthair cat with a presumed struvite urinary bladder stone and a urinary tract infection (UTI) was placed on s/d® Feline wet cat food and antibiotics. Radiographs taken 19 days after initiation of dietary and antibiotic therapy showed no evidence of the bladder stone. The cat had persistent problems with UTI (most likely associated with a perineal urethrostomy performed 28 months previously); however, despite this persistent problem, when re-evaluated 112 days following diagnosis, no evidence of uroliths were detected by survey radiography. In this case study, the cat’s struvite bladder stone dissolved despite persistent problems with a UTI.


The efficacy of s/d® Feline wet food was evaluated in 30 cases of struvite urocystoliths involving 27 cats. In 20 of these cases, sterile struvite uroliths dissolved in a mean of 36 days after initiation of dietary treatment. In five cases associated with urease-negative bacterial urinary tract infection (UTI), and three cases associated with urease-positive UTI, stones dissolved in a mean of 23 or 79 days respectively, after initiation of dietary and antibiotic treatment. In two additional cases, non-struvite uroliths did not dissolve. Use of s/d® Feline therapeutic food effectively facilitates dissolution of feline sterile struvite urolithiasis as well as those associated with urinary tract infections.


In a crossover study, ten adult female cats were fed either c/d® Multicare Feline dry or c/d® Feline dry for two weeks. In another crossover study, 10 adult female cats were fed either the c/d® Multicare Feline wet or c/d® Feline wet for two weeks. Cats had free access to deionized water during the studies. Forty-eight hour urine was collected from each cat at the end of each feeding period. The urine was collected continuously in the collection receptacles and kept at 38° C. Thymol was used as a urine antibacterial preservative. Urine samples were analyzed for pH, oxalate, calcium, magnesium, ammonium, citrate, phosphorus, and others. Urine relative supersaturation of calcium oxalate was calculated using a computer-based program, Equil 2. Cats fed the c/d® Multicare Feline dry or wet had a similar RSS of struvite when compared to those fed c/d® Feline dry or wet. Therefore, c/d® Multicare Feline is as efficacious as original c/d® Feline in reducing the risk of recurrence of struvite uroliths.

In a crossover study, 10 adult female cats were fed either the c/d® Multicare Feline dry or x/d® Feline dry for two weeks. In another crossover study, 10 adult female cats were fed either the c/d® Multicare Feline wet or x/d® Feline wet for two weeks. Cats had free access to deionized water during the studies. Forty-eight hour urine was collected from each cat at the end of each feeding period. The urine was collected continuously in the collection receptacles and kept at 38° C. Thymol was used as a urine antibacterial preservative. Urine samples were analyzed for pH, oxalate, calcium, magnesium, ammonium, citrate, phosphorus, and others. Urine relative supersaturation of calcium oxalate was calculated using a computer-based program, Equil 2. Cats fed c/d® Multicare Feline dry or wet had a similar RSS for calcium oxalate when compared to those fed x/d® Feline dry or wet. Therefore, c/d® Multicare Feline is as efficacious as x/d® Feline in reducing the risk of recurrence of calcium oxalate uroliths.

Eleven adult cats with uroliths or a medical history of uroliths (stone cats) and twelve healthy adult cats (healthy cats) were fed c/d® Multicare Feline dry for four weeks after they were fed a commercial dry cat food – Purina® Friskies® Chef’s Blend® Chicken, Beef, Salmon, Tuna Flavors (Chef)’s for four weeks. Serum vitamin E increased by more than 85% in both groups of cats fed c/d® Multicare Feline. Serum concentration of omega-3 fatty acids was also significantly increased and the ratio of omega-6 to omega-3 fatty acids was significantly decreased in cats fed the c/d® Multicare Feline when compared to those fed the commercial dry cat food (Table). Enhancement of foods with omega-3 fatty acids and antioxidant nutrients such as vitamin E may aid in nutritional management of feline idiopathic cystitis or other inflammatory urinary tract disorders.

Serum fatty acids in cats fed c/d® Multicare Feline or Chef’s Blend®

<table>
<thead>
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<th>Fatty acids</th>
<th>c/d® Multicare Feline</th>
<th>Chef’s Blend®</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Stone cats</td>
<td>Healthy cats</td>
</tr>
<tr>
<td>n-3 fatty acids, mg/dl</td>
<td>15.49*</td>
<td>14.27*</td>
</tr>
<tr>
<td>n-6 fatty acids, mg/dl</td>
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<td>50.1</td>
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<tr>
<td>n-6 fatty acid ratio</td>
<td>3.24*</td>
<td>3.57*</td>
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*Significantly different from Chef’s Blend® (p<0.01)

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Two studies were conducted to investigate the effect of urine pH on RSS of both calcium oxalate and struvite in cats. In study 1, 10 adult healthy cats were fed a nutritionally complete and balanced dry cat food for two weeks. In study 2, 10 adult cats with urinary tract stones or with medical history of urinary tract stones were fed a nutritionally complete and balanced dry cat food for four weeks. Cats in both studies had free access to deionized water during the studies. Forty-eight hour urine was collected from each cat during the last two days of the studies. The urine was collected continuously in the collection receptacles and kept at 38° C. Thymol was used as a urine antibacterial preservative. Urine samples were analyzed for pH, oxalate, calcium, magnesium, ammonium, citrate, phosphorus, and others. Urine RSS of calcium oxalate and struvite was calculated using a computer-based program, Equil 2. RSS was also calculated with arbitrarily selected urine pH input together with the analyzed concentrations of other urinary components to measure the effect of urine pH change on urine RSS of calcium oxalate and struvite. The effect of urine pH on urine RSS of calcium oxalate and struvite in healthy cats is presented in Figure 1 and in cats with uroliths in Figure 2.

Both figures show that urine pH plays a lesser role in the risk of urinary calcium oxalate urolith formation in the biological range of urine pH in cats but has a greater impact on RSS of struvite. These data and previous research support the concept that urinary pH is a less relevant factor in the formation of calcium oxalate precipitates, while it is still critical for struvite.

Figure 1. The effect of urine pH on RSS in healthy cats.

Figure 2. The effect of urine pH on RSS in cats with medical history of urinary tract stones.