

EFFICACY AND SAFETY OF TWO NEW HIGH PROTEIN – LOW CARBOHYDRATE DRY DIETS IN STERILE, FELINE STRUVITE UROLITHIASIS



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Introduction

Urolithiasis is a common cause of Feline Lower Urinary Tract Disease (FLUTD). The most common feline uroliths are calcium oxalate and struvite. Dietary dissolution is safe and effective for eradication of sterile struvite uroliths in cats. Richness in moisture and/or sodium and/or protein in order to increase water intake and thus to increase diuresis, urinary flow and the frequency of micturition may vary between commercially diets.

Materiels and methods

This **prospective, multicenter, randomized, double blinded** clinical trial evaluated the efficacy and safety of **two new high protein-low carbohydrate dry diets** (table 1) in **sterile, struvite urolithiasis** in cats with signs of non-obstructive FLUTD.

Cats enrolled in the study were **randomly** assigned either to diet A,* formulated to achieve dissolution and prevention of struvite uroliths, or to diet B,** formulated to dissolve struvite uroliths.

Cats were followed up to 14 days after the uroliths had been dissolved, latest to D56 ±2.

Physical examination, urinalysis, and abdominal ultrasound were performed weekly (figure 1).

Analyses were performed using the software SAS® version 9.4. The significance threshold was set to α=0.05 two-sided.

Results

Thirty-three cases were recruited and supplied with Diet A (n=17) or Diet B (N=16) according to the randomization procedure. Groups were comparable (table 2).

The mean time of struvite dissolution was **13.1 days** and **14 days** respectively for diet A and Diet B (n.s). The mean time to disappearance of at least one urinary sign was **7 days** for diet A and **11.4 days** for diet B (p=0.03). On D7, 70.6% of cat from group A and 68.8% of cat from group B had no more urinary signs (n.s) (table 3).

Mean urinary pH was decreased in groups A and B at the end of the study (6,1± 0.5 and 6± 0.6, respectively) compared to D0 (7,2 ± 0.8 and 7,2 ± 0.7, respectively).

In group B, **urine specific gravity** significantly decreased (p=0.01) from D0 (1.046± 9.8) to the end of the study (1.036± 12.5). In group A, urine specific gravity decrease was not significant.

According to owners' assessment, palatability was considered as good to very good in 88.2% and 93.6 % of cats with Diet A and B respectively. Two and 4 cats of groups A and B respectively exhibited transitory adverse events, possibly related to the diet (mild diarrhea or mild vomiting). These events resolved spontaneously and did not lead to the exclusion of any cat.

Analytical constituents (%DM)	Diet A*	Diet B**
Protein	46.5	46.5
Fat	14.3	16.9
Crude Fibre	6.9	4.2
Calcium	0.74	0.69
Phosphorus	0.74	0.69
Magnesium	0.09	0.09
Sodium	1.16	1.38

Table 1: Comparison of the test diets (DM: dry matter)

Baseline Characteristics	A n = 17	B n = 16	p-Value
Breed: n (%)			
European Shorthair	14 (82.4%)	13 (81.3%)	
European	1 (5.9%)	1 (6.3%)	
Main Coon	1 (5.9%)	1 (6.3%)	
Persian	1 (5.9%)	0(0.0%)	
Sphynx	0 (0.0%)	1(6.3%)	>0.99
Sex			
Female neutered	5 (29.4%)	5 (31.3%)	
Male (intact and neutered)	12 (70.6%)	11 (68.8%)	>0.99
Age (y)			
Mean (SD)	4.86 (3.29)	4.46 (3.68)	
Min	1.75	1	0.49
Max	13	14	
Body Weight (kg)			
Mean (SD)	5.6 (1.7)	4.9 (1.6)	0.21
Min	3.4	3.2	
Max	8.7	8.5	

Table 2: Comparability of baseline data

	A n = 17	B n = 16	p-Value
Time of disappearance of at least one urinary sign (days) Mean (SD)	7 (0.0)	11.4 (9.5)	>0.03 ²
Disappearance of at least one urinary sign on Day 7 n (%)	17 (100%)	12 (75%)	>0.04 ¹

Table 3: Disappearance of at least one urinary sign

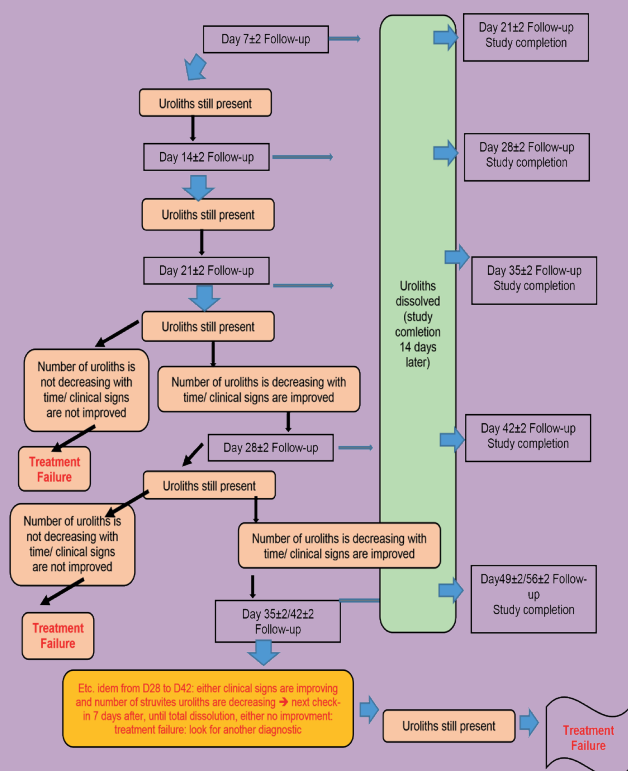


Figure 1: Flow chart-Schedule of events

*Virbac VETERINARY HPM Urology Dissolution & Prevention cat
 **Virbac VETERINARY HPM Urology Struvite Dissolution cat

Conclusion

The new high protein – low carbohydrate tested diets were effective for dissolution of feline struvite urolithiasis.

Effect of new high-protein dry diets on urinary parameters in cats and *in vitro* struvite dissolution

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Introduction

Beside urine pH, the relative supersaturation (RSS) plays an important role in dissolution of struvite uroliths and prevention of the formation of calcium oxalate uroliths in cats.¹ In an *in vitro* dissolution trial, Van Hoek *et al.* showed that RSS was a better predictor for struvite dissolution than the urinary pH.²

The aim of this study was to assess the urinary parameters and struvite crystal solubility in cats fed 3 new high-protein dry diets, in comparison to that of 2 commercial dry diets.

Animals, materials and methods

Each of 10 healthy adult cats was fed each diet (D1-D5) for a period of 7 days (dietary adaptation) prior to a 7 to 9 days collection period, in a cross-over design. D1, D2 and D3 were 3 test diets for cats, with a high protein and low carbohydrate content. D1 was intended for maintenance of adult cats. D2 was intended for "reduction of struvite stone recurrence" and D3 for "dissolution of struvite stones". D4* and D5** were commercial diets for cats, intended for "dissolution of struvite stones", used as references in this study. Daily rations were calculated to maintain the cats' body weight. Cats were housed in single cages which allowed to collect the urine. Food intake, water intake, urine volume and specific gravity were documented. Urine analyses and RSS calculations were done at the Institute of Animal Nutrition, Veterinary Faculty, Berlin. For the *in vitro* dissolution trial, 1 g of struvite crystal

(ammonium magnesium phosphate hexahydrate 98 %; VWR, Vienna, Austria) was mixed with 20 ml of the filtered (589² White Ribbon S&S) urine, 6 of these samples were prepared for each diet. Samples were stored in a 38 °C water bath and shaken (80/min). After 2 days, 3 respective samples were filtered, dried and weighed. The same procedure followed after 5 days for the remaining 3 samples of each diet.

Table 1: Nutritional characteristics of the 3 test diets

	Diet 1	Diet 2	Diet 3
Crude protein (% ME)	46	46	44
Crude fat (% ME)	36	34	38
Nitrogen Free Extract (% ME)	18	20	18
<i>In vivo</i> ME (kcal/100g)	407	413	420
Sodium (% DM)	0.80	1.14	1.36

Results

There was no significant difference in mean water intake, urinary volume and specific gravity between the 5 groups. The mean urinary pH varied from 6.0 to 6.5, it was significantly lower with D5 (Table 2). The Ca oxalate RSS varied from 4.29 to 6.58, with no significant difference between groups, and was within the range of metastable supersaturation ($1 < \text{oxRSS} < 12$) with all the diets. The struvite RSS with D1 was in the range of metastable supersaturation ($1 < \text{stRSS} < 2.5$), the other diets generated undersaturated urines with $\text{stRSS} < 1$. The struvite

solubility after 5 days was statistically similar with D1, D2 and D4, and was significantly higher with D3 and D5. There was a significant correlation (-0.401) between the struvite RSS and the struvite solubility after 5 days (Fig. 1).

Fig. 1: Correlation between struvite RSS and struvite solubility after 5 days

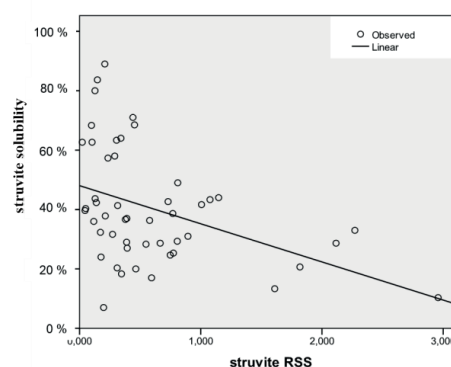


Table 2: Urinary parameters with the different diets

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Urinary pH	6.5±0.2	6.5±0.2	6.4±0.2	6.5±0.2	6.0±0.1
Struvite RSS	1.11±0.82	0.64±0.34	0.45±0.66	0.60±0.58	0.23±0.23
Ca oxalate RSS	4.35±2.41	4.68±2.68	5.89±4.02	4.29±2.54	6.58±5.17

Conclusion

The results of this study show that the test high-protein diets D2 and D3 are as efficient as the reference diets D4 and D5 for struvite dissolution. They could be recommended for both dissolution and prevention of struvite stones, and reduction of calcium oxalate stones formation in cats.

*Royal Canin Veterinary Exclusive Feline Urinary S/O **Hill's Prescription Diet s/d Feline Dissolution
References: 1) Smith *et al.* J Nutr 1998; 128: 2763S-2764S. 2) Van Hoek *et al.* Vet Focus 2009; 19: 47-48.