PURINA® PRO PLAN® VETERINARY DIETS

UR St/Ox

A Nestlé PURINA® study shows that RSS and APR values are excellent predictors of struvite dissolution kinetic in feline urine

Background

RSS (Relative SuperSaturation) and APR (Activity Product Ratio) are two methods for measuring urine mineral saturation and predicting crystal evolution. They quantify the risk of urolith formation (or dissolution) in a particular patient. Both are mathematical determinations that predict the likelihood that a stone will form in the urine.

RSS is a measure of the degree of saturation of a particular stone or crystal type in the urine. It predicts crystallisation potential of urine by analysing urine pH, volume and concentrations of various minerals.

APR adds additional information by comparing the urine RSS before and after incubation of the sample with a synthetic stone. APR is therefore a closer predictor to the situation *in vivo* as it takes into account the effects of all natural urine promoters and inhibitors of crystallisation not included in the RSS measurement.

By using RSS and APR values, urine can be classified as undersaturated (low RSS/APR), metastable or oversaturated (high RSS/APR) for the particular urolith or mineral type being studied:

- **Undersaturated:** Any existing urolith will dissolve and no new uroliths will form or grow
- **Metastable:** No new urolith will form, existing uroliths will not dissolve and may grow
- **Oversaturated:** Spontaneous crystal formation, aggregation and growth occurs. New uroliths form and grow.

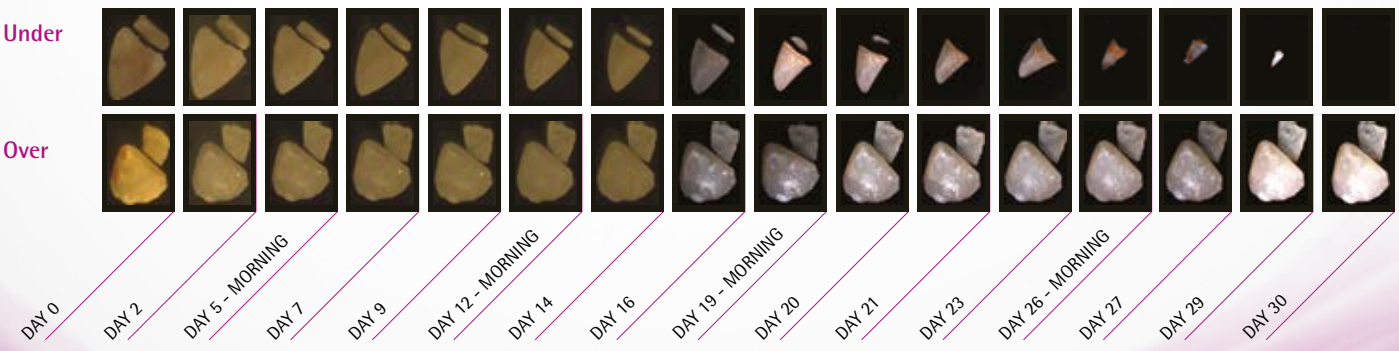
This study was designed to assess the response of struvite stones *in vitro* to undersaturated (low RSS/APR) and oversaturated (high RSS/APR) urine with particular reference to their dissolution in undersaturated urine.

Materials and Method

Urine of cats fed two different diets was assessed. Those fed diet 1 had oversaturated urine (pooled samples from 2 cats had RSS 5.216, APR 0.947) whereas those fed diet 2 (PURINA® PRO PLAN® VETERINARY DIET Feline UR St/Ox Urinary) had undersaturated urine (pooled samples from 3 cats had RSS 0.479 and APR 0.352).

Each pool of urine was divided into 20ml aliquots which were stored at -20°C. Struvite stones obtained from a veterinary clinic were selected so that one large and one small stone of approximately similar size were allocated to each group. The stones were placed in a 20ml aliquot of urine incubated at 38°C for 24 hours to mimic the cat bladder. At weekends the stones were placed in a 40ml aliquot for 48 hours. Each week day the struvite stones were recovered, dried, weighed and photographed in order to observe evolution of the stone size and then returned to a fresh aliquot of urine to repeat the process.

Results



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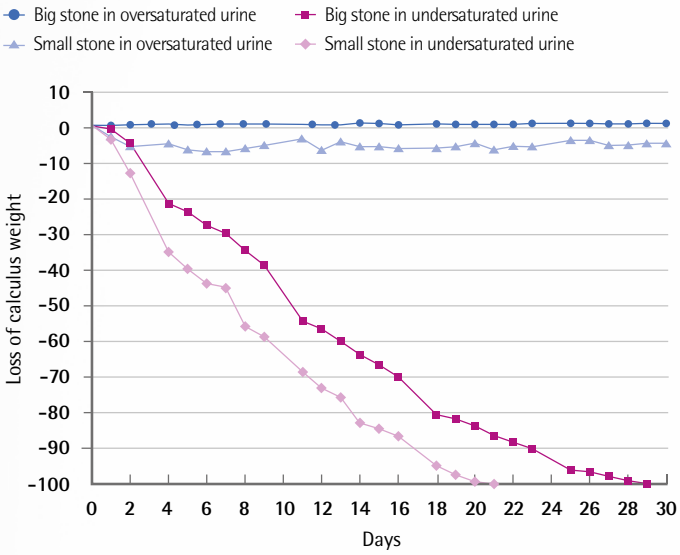
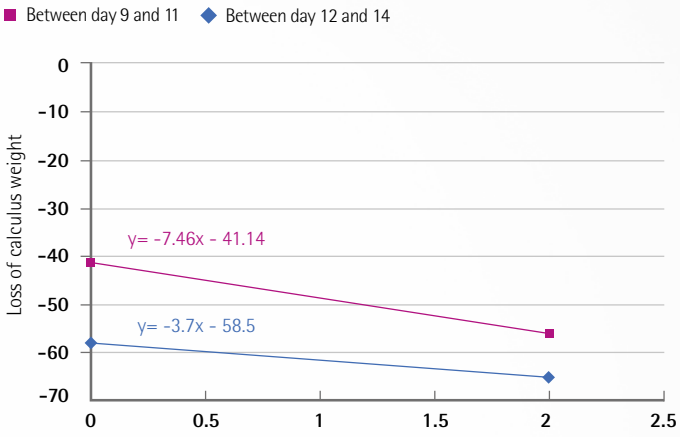
The stones placed in oversaturated urine largely kept the same size throughout the study whereas those placed in undersaturated urine decreased over time until the small stone was fully dissolved at 21 days and the larger stone was fully dissolved at 30 days. The small stone dissolved at a rate of 0.91mg/ day and the larger stone dissolved at a rate of 5.54mg/ day. Interestingly the speed on dissolution increased at the weekends when the stones were placed in a larger volume of urine.

STRUVITE STONES DISSOLUTION



Collective evolutions of stones in oversaturated and undersaturated urines

IMPACT OF URINE VOLUME ON SPEED OF DISSOLUTION



In this graph- weight loss is compared between two different periods of time- days 9 to 11 (stones in 40ml urine for 2 days) and days 12 to 14 (stones in 20ml urine for one day then a different 20ml urine for a second day).

Stones dissolved more quickly when in a larger volume of urine for a longer period

Conclusion

Urine samples with a low RSS and APR value (in the undersaturated range) allow efficient dissolution of struvite uroliths. In addition, increasing urine volume can help accelerate the process of dissolution. Diets which are designed to induce urine with low RSS and APR as well as increasing urine volume (such as Feline UR St/Ox Urinary) are recommended to manage cats with struvite uroliths.