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# Analysis of veterinary health situations in domestic animals

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## Abstract

Crystalluria is a disease that is currently present in more than 50% of the cat and dog population, causing urinary elimination dysfunction and therefore clinical signs related to toxin retention. The following study evaluated the presence of crystalluria in dogs and cats without clinical signs, attended in two veterinary clinics in Ecuador. Urine samples were collected from 150 animals, ranging from 80 dogs and 70 cats, of different ages, sexes and body index (BMI). The samples were extracted by means of the cystocentesis technique, after which the macroscopic and microscopic characteristics of the urine collected were identified by means of the uroanalysis technique. The results obtained allowed us to conclude that more than 55% of the dogs and cats present crystals, the most frequent types of crystals were amorphous urate and struvite. It is important to keep in mind that periodic evaluations allow us to reach a diagnosis in pathologies that affect the urinary system in order to improve the quality of life of our patients.

**Key words:** Crystalluria, urine, cystocentesis, uroanalysis.

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## Análsis de situaciones de salud veterinaria en animales domesticos


### Resumen

La cristaluria es una enfermedad que se presenta actualmente en más del 50% de la población de gatos y perros, causando disfunción al eliminar la orina y por lo tanto signos clínicos relacionados con la retención de toxinas. El siguiente estudio evaluó la presencia de cristaluria en perros y gatos sin signos clínicos, atendidos en dos clínicas veterinarias, en Ecuador. Se tomaron muestras de orina a 150 animales, comprendidos entre 80 perros y 70 gatos, de diferentes edades, sexos e índice corporal (IC). Las muestras fueron extraídas por medio de la técnica de cistocentesis, luego de esto y mediante la técnica del uroanálisis se identificó las características macroscópicas y microscópicas de la orina recolectada. Los resultados obtenidos nos permitieron concluir que más del 55% de los perros y gatos presentan cristales, los tipos de cristales más frecuentes fueron los uratos amorfos y la estruvita. Es importante tener en cuenta que las evaluaciones periódicas nos permiten llegar al diagnóstico en patologías que afectan al aparato urinario para mejorar la calidad de vida de nuestros pacientes.

**Palabras clave:** Cristaluria, orina, cistocentesis, uroanalisis.

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### INTRODUCTION

The urinary system has important physiological functions such as the excretion of waste substances, as well as the regulation of water

balance (Marroquín Salcedo & Granados Férnandez, 2021). Crystals in urine have a relationship with poor nutrition, metabolic problems or urinary diseases, these can be of acute or chronic presentation, usually they are recurrent very little known affecting different species of animals (Lulich et al., 2016) . Crystalluria is the union of several anatomical, behavioral and nutritional factors, which can sometimes be identified and corrected in time (Ayala-Cruz D et al., 2019). The most important factor behind the formation of uroliths is the state of urinary saturation (Hsu et al., 2022), there are 3 states of saturation: undersaturated, saturated and supersaturated and this can be influenced by the magnitude of renal excretion of crystalloid, urinary pH and/or factors that inhibit the formation or aggregation of the crystal (Jordán Delgado, 2017). The diagnosis of crystalluria has increased over the years having as more evident clinical signs the presentation of irritation in the area that generates inflammation and discomfort, generally dysuria, hematuria, stranguria, lethargy, abdominal distension and post-renal azotemia are presented with higher incidence (Piyarungsri et al., 2020).

In the case of dogs it not only affects the bladder, but also the urethra and prostate with clinical signs such as stranguria, pollakiuria, dysuria and hematuria (Rosas Martínez & García Zárate, 2017), commonly observed in daily clinic. Male dogs are the patients who most commonly present with these signs due to their anatomical characteristics, among the most common breeds are from Labrador, German Shepherd to Cocker Spaniel and Chihuahua (Ruiz Mendoza, 2021). As for the age in animals that are reported positive cases of crystalluria, they are from three months to 8 years old, coming to trigger subsequent problems such as bacterial urinary tract infections, urination abnormalities, urolithiasis, prostate diseases, and problems due to trauma (Mendoza López, 2015). In the literature it has been reported that

in American cities and in Mexico 80% of crystals found in canine sediments are of the struvite type, in the United States we find that 18% suffer from diseases of the caudal urinary tract, while in Mexico the percentage is 20% (Aké et al., 2021).

In the case of cats, crystalluria and urolithiasis is responsible for 10 to 23% of the cases of lower urinary tract diseases known as FLUTD (Feline Low Urinary Tract Disease) (Tefft et al., 2021), presenting in children under 10 years of age and approximately 10% of cats older than 10 years (Castaño Jimenez & Londoño Espinosa, 2017), similarly nephroliths can cause from obstructions at the level of the ureteropelvic junction, traveling through the ureter until reaching the kidney (Hsu et al., 2022). The formation of feline uroliths is multifactorial and depends on diet, metabolism, genetics and infectious diseases (Hsu et al., 2022).

The present research work aimed to conduct a study to establish the number of dogs and cats suffering from crystalluria using urine samples, where the presence of crystals in the urinary sediment of dogs and cats was determined by uroanalysis, to ensure an accurate and rapid diagnosis to identify an ideal treatment.

## METHODOLOGY

Urine samples from 70 cats and 80 dogs attending veterinary medical centers in Ecuador were evaluated. The selection of the patients was randomized and the medical records were filled in with the information provided by the guardians.

### Cystocentesis and Uroanalysis

For urine extraction by cystocentesis, the recommendations of (Aguiñaga Negrete et al., 2019) were followed where the patient was immobilized on top of the examination table, then the hair in the area was shaved and antisepsis was performed (Figure 1). Once

the area from which the urine sample would be extracted was prepared, the feline or canine was placed in the dorsal decubitus position, then the transducer was placed to corroborate the location in the proper organ (bladder) and the ventral puncture was performed using a 10 ml syringe. Afterwards, the needle was inserted at 45° in a caudal cranial direction through the ventral wall to avoid trauma to the ureters and abdominal vessels and placed in a test tube.

***Figure 1-A.*** Echo-guided cystocentesis. 1-B Preparation of the sample for centrifugation.

The uroanalysis technique allows us to observe blood cells, epithelial cells, casts and crystals, which is what we wanted to determine in this study and relate it to the information obtained from the anamnesis (Abdelgabar et al., 2020). To perform the uroanalysis, the steps detailed by (Meneses et al., 2021) were followed, where the macroscopic characteristics of the urine were first evaluated, such as volume, transparency or turbidity, color and odor. In the next step, the collected urine was centrifuged at 1500rpm for 5 minutes, the supernatant was removed from the

centrifuged sample and 50ul of the concentrate that remained at the bottom of the tube was collected with a Pasteur pipette and placed on a slide. Before observation under the microscope (Zeus) the sample was covered with coverslips to finally be observed with a 10X and then 40 X lens.

### Statistical design

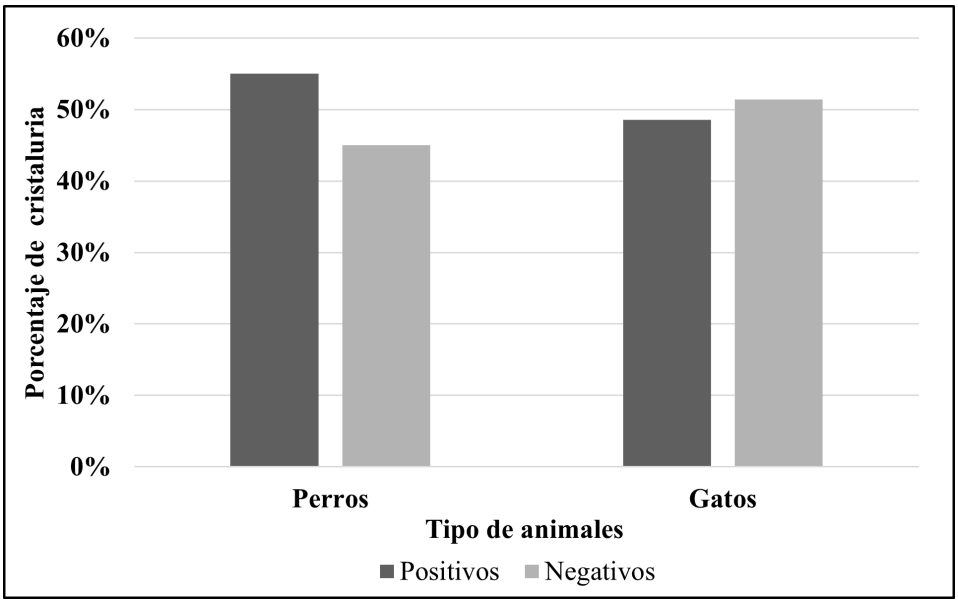
The approach of this research was quantitative since urine samples from each of the animals analyzed in the laboratory were analyzed, as well as a descriptive approach to detail the types of crystals found in the analyzed urine samples. The data obtained from the laboratory tests were tabulated and analyzed by means of a spreadsheet, the data were represented by means of descriptive tables and graphs. Descriptive statistics were used (Venables & Smith, 2024).

## RESULTS

Population of cats and dogs with the presence of crystalluria.

Figure 2 shows that, of the 80 samples analyzed in dogs, 44 positive cases were found, equivalent to 55% presence of crystalluria in dogs and 45% of cases without crystalluria. For the results of crystalluria in cats, 34 positive cases were detected, representing 48.57%, and 51.43% did not contain crystalluria.

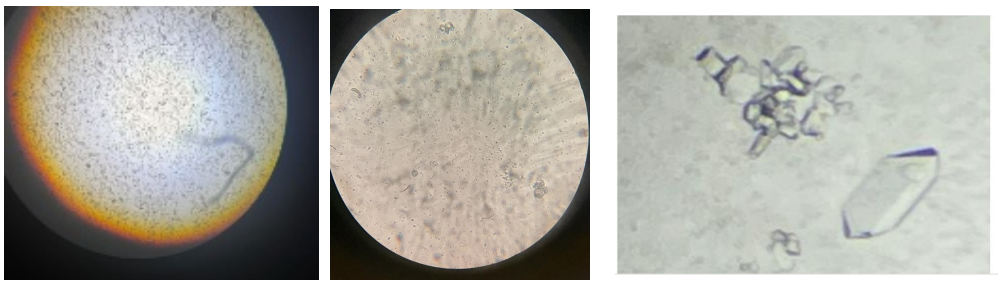
*Figure 2.* Presence of crystalluria in urine sediments of dogs and cats evaluated in veterinary clinics in Ecuador.




Types of crystals by species

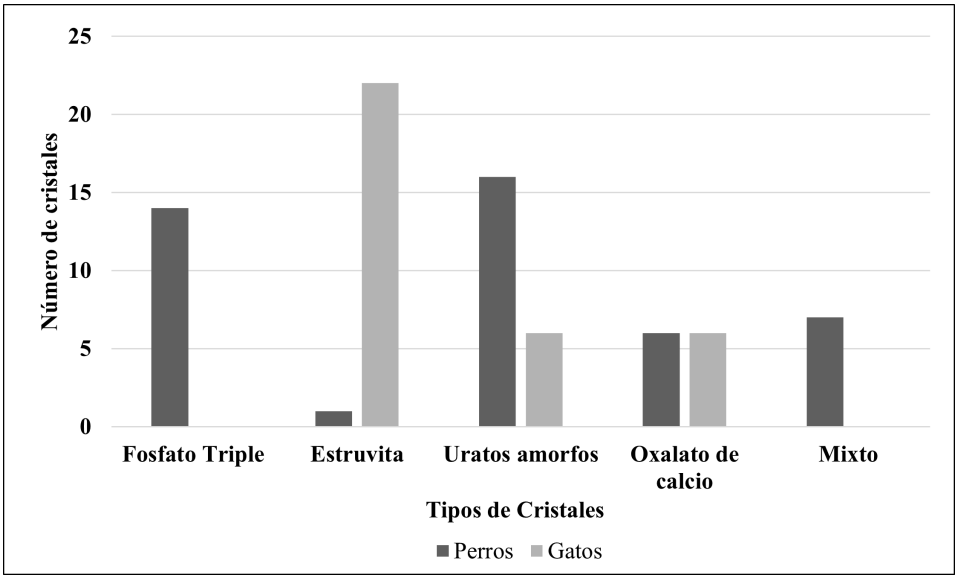
In the results of the types of crystals we can observe that, in the population of 44 positive dogs, 36% of amorphous urates and in less quantity struvite crystals with 1% (Figure 3).

*Figure 3.* Sediment samples analyzed under the microscope at 40X zoom in cats or dogs. A) Amorphous urate B) Amorphous urate C Struvite



In the case of cats we found that of the 34 that tested positive for crystals, 64.70% were of the struvite type and 6% amorphous urate (Figure 4).

*Figure 4.-* Bar graph showing the levels of crystalluria found in cats and dogs of the 150 samples evaluated.




## Influence of age, sex, diet and CHF in patients with crystalluria.

To identify whether characteristics such as animal age, sex, type of diet and body index (BMI) influence the presence of crystalluria in patients, we compared the results obtained with the information provided from the medical records. The results of the presence of crystalluria according to the age of the animal are shown in Table 1 where it is observed that 66% of senior dogs have a higher percentage of crystalluria, compared to cats that show 64.70% of crystalluria, but in adulthood.

Table 1. *Presence of crystalluria according to age.*

| Crystalluria according to age | Dogs | | Cats | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| **Puppy** | 0 | 0% | 0 | 0% |
| **Adult** | 23 | 52.27% | 22 | 64.70% |
| **Senior** | 21 | 66% | 12 | 35.29% |
| **Total** | 44 | 100% | 34 | 100% |

Regarding the sex of the animal in Table 2 we observe that in dogs, females are the ones with the highest percentage of crystalluria with 54.54% as opposed to cats that obtained 76.47% of crystalluria.

Table 2. *Presence of crystalluria according to the sex of the animal.*

| Crystalluria by sex | Dogs | | Dogs | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| **Female** | 24 | 54,54% | 8 | 23,52% |
| **Male** | 20 | 45,45% | 26 | 76,47% |
| **Total** | 44 | 100% | 34 | 100% |

Regarding the type of food consumed by the patients in the study, Table 3 shows that the two species reached high percentages of 75% in dogs and 85.29% in cats in the consumption of dry balanced food.

Table 3. *Presence of crystalluria according to type of food.*

| Power supply type | dogs | | cats | |
|---|---|---|---|---|
| | Positive | Porcentage | Positive | Negative |
| Balanced | 33 | 75% | 29 | 85,29% |
| Homemade food | 11 | 25% | 5 | 14,70% |
| Total | 44 | 100% | 34 | 100% |

Finally, according to the CCI, Table 4 shows that level 3 in dogs has 47.72% of patients with crystalluria, while in cats the highest CCI levels with presence of crystalluria are 3 and 4 with 38.23%.

Table 4. *Presence of crystalluria according to CI,*

| Body Condition (ICC) | Dogs | | Cats | |
|---|---|---|---|---|
| | Number | Porcentage | Number | Porcentage |
| 1 | 0 | 0% | 0 | 0% |
| 2 | 4 | 9,09% | 8 | 23,52% |
| 3 | 21 | 47,72% | 13 | 38,23% |
| 4 | 18 | 40,90% | 13 | 38,23% |
| 5 | 1 | 2,27% | 0 | 0% |
| Total | 44 | 100% | 34 | 100% |

In the present study 150 animals were evaluated, 80 dogs and 70 cats with presence of crystalluria, in which in general we observed that more than 50% of cats and dogs showed presence of crystalluria, similar evaluations in Mexico in 2019 show high levels of crystalluria in animals attended in consultation (Ayala-Cruz D et al., 2019) In our study the type of crystalluria that was found in most of the dogs evaluated was amorphous urates and in smaller amounts struvite, which differs with other studies conducted in Mexico in which more than 70% of the samples were struvite (Aké et al., 2021), and another study conducted in the city of Guayaquil in cats that showed a similar percentage in the presence of struvite.(Lozano Pazmiño, 2020).

If we compare factors such as sex, coincidentally we found that in our samples the most predominant with presence of crystalluria in dogs are females, similar results have been obtained with urine samples in dogs in the city of Quito that found more positive cases in females (Rosero Gómez, 2014), in the case of cats we found a greater presence of crystalluria in males, similarly when comparing our results with other studies we found that most of the cases reported in Venezuela were in males with 63.58% (Polat et al., 2022). However, the presence of crystals is not a factor linked to sex, since we have been able to observe that they are present in both sexes indistinctly, but the anatomical characteristics of males make them more susceptible to show them.

The feeding by means of dry type balanced feed had a higher frequency of positivity of crystalluria, compared to other types of feed, such as homemade, this result is closely related to a study done in the city of Quito where commercial diets were tested showing that the percentages of higher presence of crystals were in animals that consumed this type of feed (Idrovo Torres & Parra Pacheco, 2020). It should be taken into account that, although this type of food is the most frequently recommended, because it is

practical and provides a better supply of nutrients, the results show that it can generate a greater presence of crystalluria in symptomatic and asymptomatic patients, so further research is recommended to evaluate diets and possible sensitivities to this type of components.

Both in adult dogs and cats a greater presence of crystalluria was found, similar works reflect that crystalluria is present in all ages (Aké et al., 2021), however, physiologically it is more common in adult patients and seniors due to a normal degeneration of the urinary system organs preventing a normal elimination of the mineral concentrations coming from the different types of food. In reference to the body condition index (BCI), dogs presented level 3 and cats level 3 and 4, which shows that most of the animals evaluated maintain an ideal weight (level 3) and overweight (level 4). It is necessary to take into account that the ICC is related to the type of food consumed by the animal (Lulich et al., 2016), which shows us that some of the animals evaluated maintain an uncontrolled habitual diet which can affect their health and can favor the formation of mineral concentrations in the urine, presence of bacteria, or impede the proper functioning of the urinary system. Therefore, it would be advisable to improve the feeding, which would allow to reduce the formation of crystals and their progressive elimination.

## CONCLUSIONS

In this study we were able to conclude that more than half of the animals evaluated had crystalluria, being able to say that it is a pathology that can be both in symptomatic or asymptomatic animals, therefore, the performance of timely and rapid examinations such as a uroanalysis will give us the opportunity to prevent the appearance of other signs or complications. Sex, age

and ICC are factors that do not seem to have relevance in the appearance of crystalluria, however, it is recommended to perform timely examinations and maintain a quality diet, constant water consumption in order to avoid factors that predispose to the appearance of this pathology, especially in animals that have a genetic predisposition which would alter their health and quality of life.

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