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RESEARCHES REGARDING THE PARACLINICAL CORRELATIONS BETWEEN URINALYSIS AND WATER INTAKE IN CATS WITH FELINE UROLOGIC SYNDROME

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Abstract

The research aimed the direct correlations between the water composition and feline urological syndrome prognosis. The study was conducted on 60 patients aged between 1 and 10 years divided into two batches of 30 each. The first batch (LOT1) was represented by 30 oliguric patients, with a value of urinary specific gravity (USG) >1.055, an acidic pH and a urinary protein/creatinine ratio (UPC) >0.2, and the second batch (LOT2) was represented by 30 polyuric patients, with a urinary specific gravity (USG) <1.035, a neutral or alkaline pH and a urinary protein/creatinine ratio (UPC) <0.2 or borderline (0.2-0.4). In the first batch (LOT1), alkaline water without sodium and potassium, was administered. The water was based on a salt-free formula with a pH of 8.0 and 10 ppm of potassium. In the second batch (LOT2), a neutral water with potassium was used. The water was based on a formula with salts (magnesium citrate, calcium acetate and sodium bicarbonate), with a pH of 7.0 and 12.5 ppm potassium. In both batches, the evaluation of the USG, the pH and the UPC was carried out for 180 days, at 30, 90 and 180 days. Hydration is an essential component in the management of patients diagnosed with feline urological syndrome. Administering an alkaline hydric diet in patients with aciduria is a solution to counteract the effect of metabolism on urinary pH. Potassium supplementation in polyuric patients is a beneficial solution in hypokalemia therapy. Potassium restriction in oliguric patients is a beneficial solution in the therapy of hyperkalemia.

Key words: urinalysis, water, feline, urological, syndrome

Hydration is defined by the amount of water in the body, and maintaining normal hydration is essential for felines. A variety of vital body functions are closely related to adequate water intake, such as regulating body temperature, maintaining normal electrolyte concentrations, digesting food, and delivering oxygen and other nutrients to organs. [Zanghi B., 2017]

Increasing water intake in cats is a primary management strategy for various conditions. Patients are prone to dehydration from polyuria, hyperthyroidism, chronic kidney disease, and diabetes insipidus. Patients who develop feline lower urinary tract are also prone to dehydration. These include all conditions of the urinary bladder, urethra, such as bacterial infections, urethral plugs, urolithiasis, idiopathic cystitis, bladder neoplasia. [Buckley C.M. et al., 2011]

Numerous strategies are described in the literature to increase fluid intake in cats. These include increasing the amount of wet food in the diet, providing fresh water at all times, and providing supplemental water through various methods such as dynamic water fountains. [Robbins M.T., 2019]

Water is distributed in different compartments in the body. About 2/3 of the total water in the body belongs to the intracellular fluid compartment. This fluid is inside the cells in the body. The other third belongs to the extracellular fluid compartment, which includes interstitial fluid and plasma. About 2% of the total water is the transcellular fluid compartment, and it consists of cerebrospinal, gastrointestinal, respiratory and synovial fluid. Fluids and electrolytes can move from one compartment to another to support homeostasis. [Wellman M.L. et al., 2006]

There are no studies that conclusively demonstrate how much water cats need on a daily basis. Most sources available in the literature agree that an adult cat needs approximately 44 to 66 ml/kg/day. Kittens need a relatively larger amount of water and a dose of 66-88 ml/kg/day is recommended. These figures represent the total water requirement, including drinking water, food water and metabolic water. [Rossi T.A., Ross, 2008; Pachel C., Neilson J., 2010]

The increased incidence of cases with feline urological syndrome (FUS), the conditions that generate this pathology, the inadequate water intake and the improvement of therapeutic protocols, were the basis for the initiation of these researches. Patients should also have a complete urinalysis performed at regular intervals. The research of this paper has the primary goal of saving the lives of companion animals by perfecting hydration methods and represents a starting point for the appropriate management of patients diagnosed with feline urological syndrome.

MATERIAL AND METHOD

This study was conducted on a number of 60 feline patients aged between 1 and 10 years. The 60 patients were divided into two groups of 30 each.

The first batch (LOT1) was represented by 30 oliguric patients, with a value of urinary specific gravity (USG) >1.055, an acidic pH and a urinary protein/creatinine ratio (UPC) >0.2. The patients were aged between 1 and 10 years, of which, 23 males and 7 females.

The second batch (LOT2) was represented by 30 polyuric patients, with a urinary specific gravity (USG) <1.035, a neutral or alkaline pH and a urinary protein/creatinine ratio (UPC) <0.2 or borderline (0.2-0.4). The age of the patients in this batch was between 1 year and 10 years, of which 24 were male and 6 were female.

In the first batch (LOT1), alkaline water without sodium and potassium, was administered. The water was based on a salt-free formula with a pH of 8.0 and 10 ppm of potassium.

In the second batch (LOT2), a neutral water with potassium was used. The water was based on a formula with salts (magnesium citrate, calcium acetate and sodium bicarbonate), with a pH of 7.0 and 12.5 ppm potassium.

In both batches, the evaluation of the USG, urinary pH and the UPC was carried out for 180 days, at 30, 90 and 180 days.

All urine samples were collected sterilely by cystocentesis, under ultrasound guidance.

The collected urine sample was instilled on a urine strip, then processed by an automatic urine biochemistry machine.

The result of the urine tests was provided within 60 seconds.

The urine strips used have the ability to measure 14 urinary biochemical parameters (e.g.: leukocytes, ketone bodies, urobilinogen, glucose, pH, urine density, etc.).

At the same time, this device also calculates the protein/creatinine ratio (UPC).

Figure 1. Ultrasound guided cystocentesis (orig.)

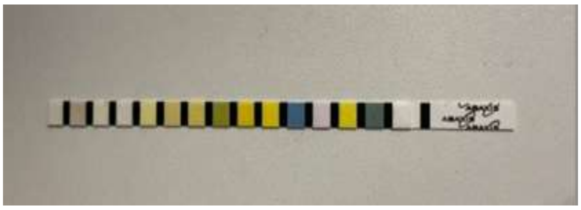

Figure 2. Urine strip with the 14 parameters measured. (orig.)

Figure 3. Automatic urine biochemistry machine. (orig.)

Patients in both batches (LOT 1, n=30; LOT 2, n=30) were administered daily 44-66 ml/kg of water.

RESULTS AND DISCUSSIONS

At presentation, all patients from batch LOT 1 (n=30), had an USG between 1.060 (n=14) and 1.055 (n=16). (Figure 4)

On day 30, patients from batch LOT 1 (n=30) had USG between 1.040 and 1.055, as follows: 1.040, n=1; 1.045, n=3; 1.050, n=18; 1.055, n=8. (Figure 4)

On day 60, patients from batch LOT 1 (n=30) had USG between 1.040 and 1.050, as follows: 1.040, n=12; 1.045, n=17; 1.050, n=1. Figure 4

On day 90, patients from batch LOT 1 (n=30) had USG between 1.035 and 1.045, as follows: 1.035, n=11; 1.040, n=15; 1.045, n=4. (Figure 4)

On day 180, patients from batch LOT 1 (n=30) had USG between 1.035 and 1.045, as follows: 1.035, n=15; 1.040, n=15. (Figure 4)

At presentation, and also on day 30 all patients from batch LOT 1 (n=30), had an UPC ratio >0.2. (Table 1)

On day 60, patients from batch LOT 1 (n=30) had an UPC ratio as follows: >0.2, n=18; <0.2, n=12. (Table 1)

On day 90 and also on day 180, all patients from batch LOT 1 (n=30), had an UPC ratio <0.2. (Table 1)

At presentation, all patients from batch LOT 1 (n=30), had an urinary pH between 5.0 and 6.5 as follows: pH 5.0, n=5; pH 5.5, n=19; pH 6.0, n=4; pH 6.5, n=2. (Figure 5)

On day 30, patients from batch LOT 1 (n=30) had an urinary pH between 5.0 and 6.5, as follows: pH 5.0, n=14; pH 5.5, n=14; pH 6.0, n=0; pH 6.5, n=2. (Figure 5)

On day 60, patients from batch LOT 1 (n=30) had an urinary pH between 5.5 and 6.5, as follows: pH 5.5, n=21; pH 6.0, n=7; pH 6.5, n=2. (Figure 5)

On day 90, patients from batch LOT 1 (n=30) had an urinary pH between 6.0 and 6.5, as follows: pH 6.0, n=26; pH 6.5, n=4. (Figure 5)

On day 180, patients from batch LOT 1 (n=30) had an urinary pH between 6.0 and 6.5, as follows: pH 6.0, n=26; pH 6.5, n=4. (Figure 5)

At presentation, patients from batch LOT 2 (n=30) had USG between 1.010 and 1.025, as follows: 1.010, n=8; 1.015, n=9; 1.020, n=10; 1.025, n=3. (Figure 6)

On day 30, patients from batch LOT 2 (n=30) had USG between 1.010 and 1.030, as follows: 1.010, n=4; 1.015, n=8; 1.020, n=8; 1.025, n=8; 1.030, n=2. (Figure 6)

On day 60, patients from batch LOT 2 (n=30) had USG between 1.015 and 1.035, as follows: 1.015, n=2; 1.020, n=6; 1.025, n=12; 1.030, n=4; 1.035, n=6. (Figure 6)

On day 90, patients from batch LOT 2 (n=30) had USG between 1.025 and 1.040, as follows: 1.025, n=2; 1.030, n=2; 1.035, n=18; 1.040, n=8. (Figure 6)

On day 180, patients from batch LOT 2 (n=30) had USG between 1.035 and 1.040, as follows: 1.035, n=18; 1.040, n=12. (Figure 6)

At presentation, and also on day 30 all patients from batch LOT 2 (n=30), had an UPC ratio between 0.2 and 0.4. (Table 2)

On days 60, 90 and 180, all patients from batch LOT 2 (n=30), had an UPC ratio <0.2. (Table 2)

At presentation, all patients from batch LOT 2 (n=30), had an urinary pH between 7.0 and 8.0 as follows: pH 7.0, n=11; pH 7.5, n=15; pH 8.0, n=4. (Figure 7)

On day 30, patients from batch LOT 2 (n=30) had an urinary pH between 6.0 and 7.5, as follows: pH 6.0, n=1; pH 6.5, n=8; pH 7.0, n=13; pH 7.5, n=8. (Figure 7)

On day 60, patients from batch LOT 2 (n=30) had an urinary pH between 6.0 and 7.0, as follows: pH 6.0, n=1; pH 6.5, n=20; pH 7.0, n=9. (Figure 7)

On day 90, patients from batch LOT 2 (n=30) had an urinary pH between 6.0 and 7.0, as follows: pH 6.0, n=14; pH 6.5, n=13; pH 7.0, n=3. (Figure 7)

On day 180, patients from batch LOT 2 (n=30) had an urinary pH between 6.0 and 6.5, as follows: pH 6.0, n=20; pH 6.5, n=10. (Figure 7)

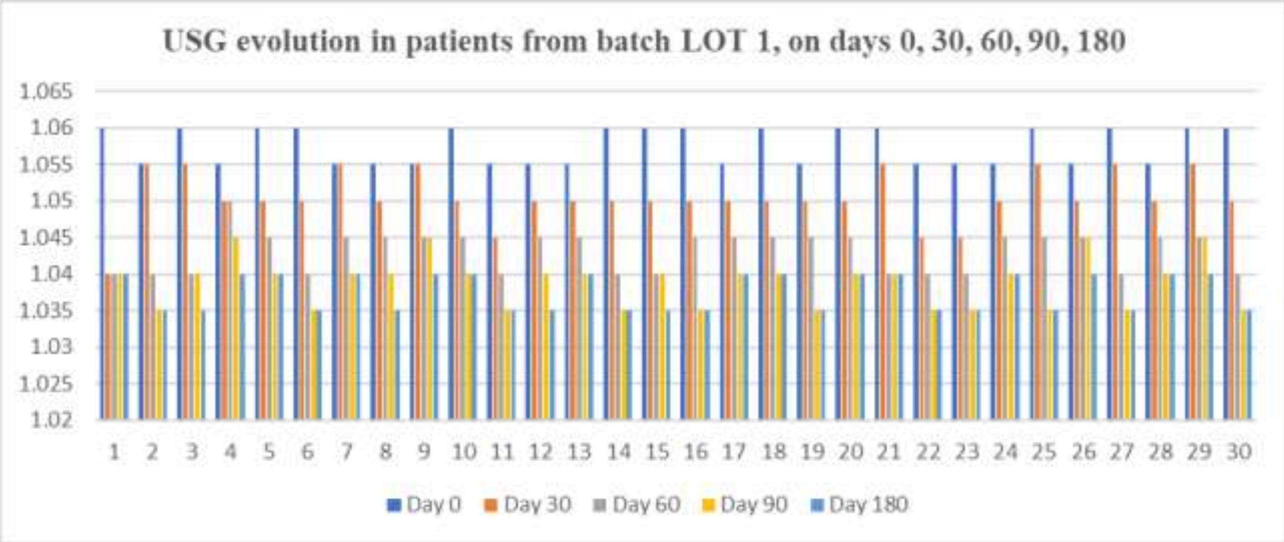

Figure 4. Graphical representation of the evolution of urine density (USG) of all cases that are part of batch LOT 1 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

Table 1.

Evolution of UPC of all cases that are part of batch LOT 1 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

PATIENT NO.	PATIENT	DAY 0	DAY 30	DAY 60	DAY 90	DAY 180
P1	M, 5 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P2	M, 6 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P3	M, 4 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P4	F, 9 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P5	M, 7 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P6	M, 1 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P7	M, 8 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P8	F, 9 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P9	M, 4 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P10	M, 1 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P11	M, 3 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P12	F, 7 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P13	M, 2 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P14	M, 9 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P15	F, 10 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P16	M, 3 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P17	M, 5 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P18	M, 1 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P19	F, 8 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P20	M, 4 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P21	M, 2 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P22	M, 8 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P23	M, 3 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P24	F, 9 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P25	M, 6 YO	>0.2	>0.2	>0.2	<0.2	<0.2

P26	M, 4 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P27	F, 10 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P28	M, 2 YO	>0.2	>0.2	>0.2	<0.2	<0.2
P29	M, 5 YO	>0.2	>0.2	<0.2	<0.2	<0.2
P30	M, 2 YO	>0.2	>0.2	>0.2	<0.2	<0.2

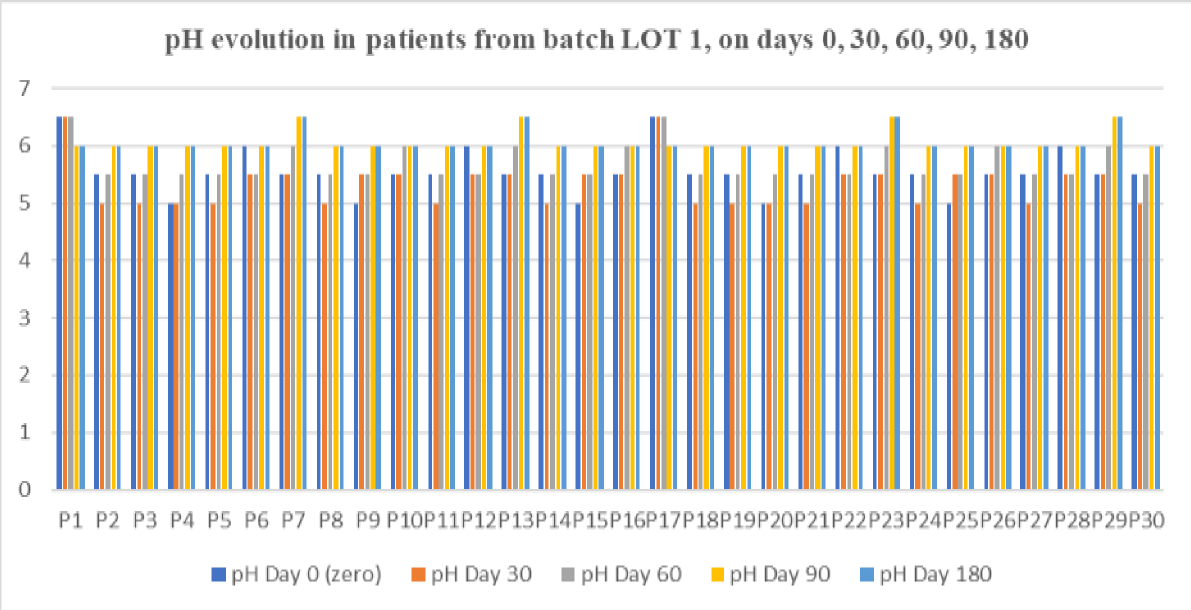

Figure 5. Graphical representation of the evolution of urinary pH of all cases that are part of batch LOT 1 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

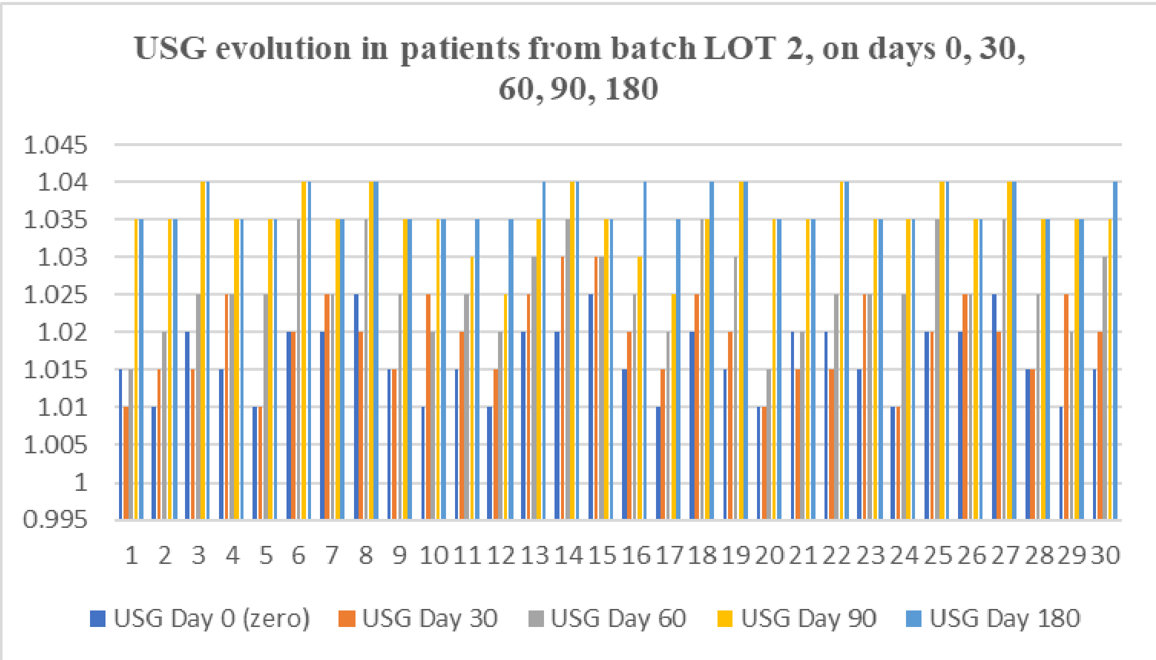

Figure 6. Graphical representation of the evolution of urine density (USG) of all cases that are part of batch LOT 2 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

Table 2.

Evolution of UPC of all cases that are part of batch LOT 2 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

PATIENT NO.	PATIENT	DAY 0	DAY 30	DAY 60	DAY 90	DAY 180
P1	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P2	M, 6 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P3	M, 4 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P4	F, 10 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P5	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P6	M, 1 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P7	M, 8 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P8	F, 7 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P9	M, 4 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P10	M, 2 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P11	M, 5 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P12	F, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P13	M, 2 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P14	M, 8 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P15	F, 8 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P16	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P17	M, 4 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P18	M, 2 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P19	M, 7 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P20	M, 5 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P21	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P22	M, 2 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P23	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P24	F, 9 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P25	M, 7 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P26	M, 4 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P27	F, 18 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P28	M, 3 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P29	M, 4 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2
P30	M, 1 YO	0.2 - 0.4	0.2 - 0.4	<0.2	<0.2	<0.2

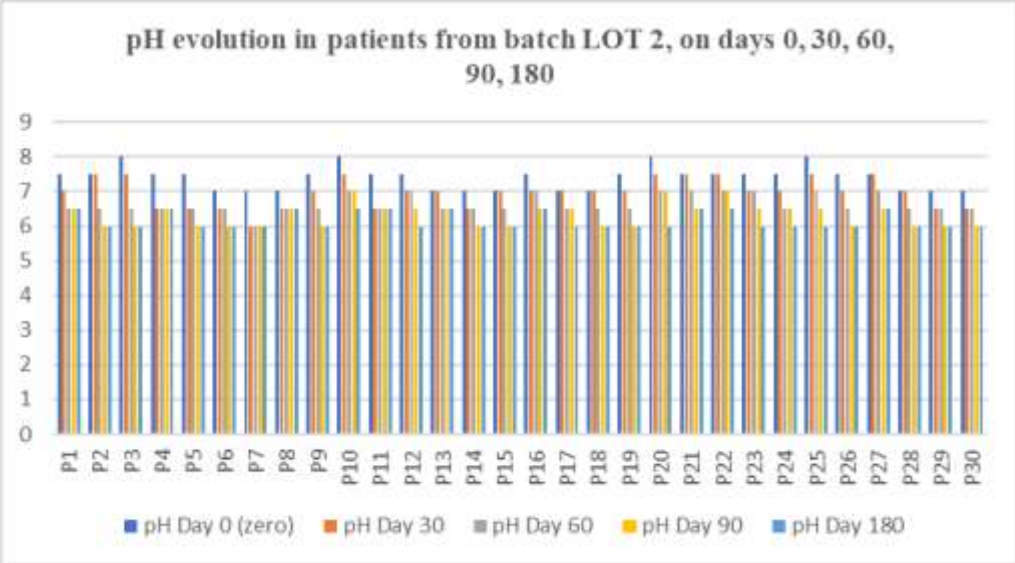

Figure 7. Graphical representation of the evolution of urinary pH of all cases that are part of batch LOT 2 (n = 30), on the day of presentation (day 0), at one month (day 30), at two months (day 60), at three months (day 90) and 6 months (day 180) days.

CONCLUSIONS

Hydration is an essential component in the management of patients diagnosed with feline urological syndrome.

Administering an alkaline hydric diet in patients with aciduria is a solution to counteract the effect of metabolism on urinary pH.

Potassium supplementation in polyuric patients is a beneficial solution in hypokalemia therapy.

Potassium restriction in oliguric patients is a beneficial solution in the therapy of hyperkalemia.

Monitoring the pH, USG and UPC is mandatory in adapting the therapy of patients diagnosed with feline urological syndrome.

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