

pH (Urine)

Interpretive Summary

Description: The pH of urine is an index of acid-base balance but is not a reliable indicator of blood pH.

Decreased pH (Acidic)

Common Causes

- Metabolic acidosis
 - Ethylene glycol intoxication
 - Diabetic ketoacidosis
 - Renal failure
 - Lactic acidosis
 - Addison's disease
- High protein or milk-based diet
- Paradoxical aciduria (acid urine pH with metabolic alkalosis) due to severe vomiting

Uncommon Causes

- Medications or toxins
 - Carbonic anhydrase inhibitors
 - Salicylate
 - Paraldehyde
 - Methanol
 - Urinary acidifiers
 - Furosemide
- Respiratory acidosis
- Vomiting with chloride depletion or severe diarrhea
- Proximal renal tubular acidosis with bicarbonate depletion
- Fever, starvation, or prolonged exercise
- Decreased serum potassium
- Hydrogen production by bacteria

Related Findings

- Metabolic Acidosis
 - Ethylene glycol intoxication
 - Increased BUN, creatinine, phosphorus, anion gap
 - Decreased calcium
 - Calcium oxalate monohydrate crystalluria
 - Diabetic ketoacidosis
 - Increased blood glucose, BUN, creatinine, ALP, ALT
 - Decreased sodium, TCO₂, increased or decreased potassium
 - Glucosuria and ketonuria
 - Renal failure
 - Increased BUN, creatinine, phosphorus
 - Decreased TCO₂
 - Decreased urine specific gravity
 - Lactic acidosis
 - Increased sodium, chloride and TCO₂
 - Increased hematocrit
 - Addison's Disease

- Decreased sodium, albumin, cholesterol
 - Increased potassium, BUN, creatinine
 - Low urine specific gravity
- Paradoxical aciduria (acid urine pH with metabolic alkalosis)
 - Increased TCO₂
 - Decreased chloride, potassium

Increased pH (Alkaline)

Common Causes

- Recent meal (postprandial alkaline tide)
- Artifact
 - Delayed sample analysis (spontaneous degeneration of urea)
 - Pigmenturia
- Urinary tract infection (UTI) with urease-producing bacteria (*Staphylococcus* spp., *Proteus* spp.)

Uncommon Causes

- Metabolic alkalosis
- Respiratory alkalosis
- Proximal renal tubular acidosis (early) or distal renal tubular acidosis
- Diets rich in vegetables and cereals

Related Findings

- Urinary tract infection with urease-producing bacteria
 - Pyuria, hematuria, bacteriuria
 - Positive urine culture with growth of *Staphylococcus* spp. or *Proteus* spp.
 - +/- Struvite crystalluria

Additional Information

Physiology

- Urine pH is a measure of the hydrogen ion concentration in urine.
- Urine pH is determined by the kidney's ability to regulate hydrogen ion and bicarbonate concentrations within the blood.
- Normal urine pH in dogs and cats: 6.0-7.5
- Urine pH is variable based on diet
 - Cats and dogs usually have acidic urine
 - Anorexia can cause an acidic urine
 - Cats and dogs on vegetable-based diet may have an alkaline urine

References

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- Willard MD, Tvedten H, eds. *Small Animal Clinical Diagnosis by Laboratory Methods*, 4th ed. St. Louis, MO: Saunders; 2004.

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