URINE PROPERTIES OF CAPTIVE BLACK-TAILED PRAIRIE DOGS (*CYNOMYS LUDOVICIANUS*)

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Abstract

A total of 15 healthy captive black-tailed prairie dogs (*Cynomys ludovicianus*) of both sexes were studied to determine urine properties of this species as part of an overall clinical health evaluation performed under general isoflurane anesthesia. Each animal underwent a complete physical examination, complete blood count, serum biochemistry panel, whole-body radiology, and cardiographic examination. Urine samples were collected via ultrasound-guided cystocentesis. Each urine sample was evaluated biochemically for the presence of glucose, bilirubin, ketones, pH, proteins, hemoglobin, specific gravity, creatinine, and gamma-glutamyl transferase (GGT); macroscopically or microscopically for color, clarity, erythrocytes, leukocytes, casts, epithelial cells, and crystals; and for pathogenic leptospires by polymerase chain reaction testing. Urinary GGT to creatinine and protein to creatinine ratios were also calculated. Cloudy urine was common but not as a result of calciuria as observed in other rodents. The primary urine properties identified in this study are presented (median: minimum to maximum) and include the specific gravity (1.25: 1.005 to 1.059), GGT (883: 12 to 5833 U/L), creatinine (6064: 1485 to 15,939 μmol/L or 68.6: 16.8 to 180.3 mg/dL), protein (19: 6 to 124 mg/dL), GGT to creatinine ratio (0.112: 0.008 to 0.606), and protein to creatinine ratio (0.3: 0.2 to 1.0), which was higher in males when compared with females. Urine pH as determined by the urine dipstick was 8 to 8.5. New data presented in this report can promote better physiological understanding and improve clinical management of this rodent species.

Key words: black-tailed prairie dog; *Cynomys ludovicianus*; rodent; urinalysis

The black-tailed prairie dog (*Cynomys ludovicianus*) is a member of the order Rodentia and the family Sciuridae.[1] It is 1 of 5 species of prairie dogs, a keystone species in the grasslands of North America, and the most common species found in zoological collections, research facilities, and private homes.[1,2] When evaluating the health status of a black-tailed prairie dog patient, knowledge of urine properties can contribute to better understanding of the species' physiology and aid in clinical evaluation of sick animals.[3,4] The anatomical structure and function of the kidney of the black-tailed prairie dog has been described in detail[3,5,6], including the daily volume of urine produced, urine osmolality, and urea, ammonia, sodium, potassium and bis(2-hydroxypropyl)amine urinary concentrations.[3,5] Several urine properties such as the mean daily urine volume, mean daily urinary bis(2-hydroxypropyl)amine, creatinine and urea production, and urinary urea/creatinine ratio were also described for a related species, the white-tailed prairie dog (*Cynomys leucurus*).[7] However, despite sharing similar renal morphology, several differences in urine properties (e.g., higher daily urinary urea, ammonia, and potassium) were noted in black-tailed prairie dogs when compared with white-tailed prairie dogs that were attributed to differences in renal function and other physiological functions

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between the 2 species,[6] thus emphasizing the need for generating species-specific physiological data. This study was therefore designed to explore and to describe urine properties of the black-tailed prairie dog.

MATERIALS AND METHODS

Animals

A total of 15 apparently healthy prairie dogs were admitted for an overall health evaluation and were sampled in this study. Median age was 6 months (min = 6 and max = 54) and median weight was 791 g (min = 582 and max = 1200). The prairie dogs originated from 2 separate zoological collections (Kansas, USA); animals (10 males) from one collection were maintained in an open-air enclosure, whereas animals (5 females) from the second collection were housed in an indoor enclosure. All animal care procedures conformed to guidelines established by the Institutional Animal Care and Use Committee at Kansas State University (IACUC, Approval no. 3311).

Anesthesia and Experimental Protocol

Each prairie dog was chamber-induced using 5% isoflurane gas (IsoFlo; Abbott Laboratories, North Chicago, IL USA) in 2 L/min oxygen. Following induction, the subject animals were maintained under general anesthesia using a small facemask and nonrebreathing circuit using 2.5% isoflurane delivered via 1.5 L/min of oxygen. The animals were allowed to spontaneously breathe. Body temperature was monitored rectally using a handheld digital thermometer and maintained using a warm water blanket and heating packs. Vital signs were monitored using a stethoscope, a Doppler (Parks Doppler System Model 811-B; Parks Medical Electronics, Inc., Aloha, OR USA) and a pulse oximeter (Nellcor Handheld Pulse Oximeter N20PA, Covidien, Dublin, Ireland).

Handling and Examination of Animals

Following induction of anesthesia, each animal was weighed and a complete physical examination was performed. A complete blood count, serum biochemistry panel, whole-body radiographic imaging, and echocardiography were performed and all animals were deemed healthy.

Urine Sample Collection and Analysis

While under general anesthesia, each prairie dog was placed in dorsal recumbency. The area around the caudal third of the abdomen was aseptically prepared using 70% isopropyl alcohol. An ultrasound-guided cystocentesis was performed using a 12-MHz ultrasound probe to visualize the urinary bladder, and 3 to 5 mL of urine was collected via a 6.0-mL syringe with a 22-gauge 1.5-in needle. The urine sample was immediately submitted and processed. The urine dipstick test (urinalysis reagent strip, Multistix 10 SG; Siemens Healthcare Diagnostics, Tarrytown, NY USA) was performed according to the manufacturer's guidelines. In brief, the measuring stick was immersed in urine, excess urine was removed, and the reagent strip was read using an automatic urinalysis system (Clinitek 100 kit; Bayer, Elkhart, IN USA). Glucose-positive results were verified by additional testing (Clinitest tablets; Bayer, Elkhart, IN USA) according to the manufacturer's guidelines. In brief, Clinitest was performed by combining 5 drops of urine with 10 drops of distilled water, adding the tablet, and evaluating the results from a color chart after the reaction was finished. The urine specific gravity (USG) was measured with a handheld refractometer (Leica 10436 Veterinary Refractometer; Kernco Instruments Co., El Paso, TX USA). The refractometer had an automatic temperature compensation for temperatures between 10°C and 30°C. The scale on the refractometer ranged from 1.000 to 1.060, with increments of 0.001. Before every reading, the refractometer was thoroughly cleaned and calibrated to 1.000 using distilled water. A urine protein sulfosalicylic acid (SSA) precipitation test was performed by adding 1.5 mL of urine to 4.5 mL of 3% SSA and the resultant turbidity was compared to Kingsbury-Clark standards (Cargille Scientific, Inc., Cedar Grove, NJ USA). The urine protein to creatinine (UPC) ratio was calculated by dividing the urine total protein concentration (determined by the benzethonium chloride reaction by use of an automated chemistry analyzer [COBAS C501, Hitachi 911; Roche Diagnostics, Indianapolis, IN USA] by the urine creatinine concentration (determined via the buffered kinetic Jaffe reaction by use of an automated chemistry analyzer; [COBAS C501, Hitachi 911, Indianapolis, IN USA]). The urine GGT to creatinine (UGC) ratio was calculated by dividing the urine GGT concentration (U/L)