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# Serum Creatinine Concentrations in Retired Racing Greyhounds

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**Background:** Greyhounds frequently have laboratory values that are outside reference intervals established for dogs. Our recognition of increased serum creatinine concentrations in several Greyhounds posed a problem when evaluating a Greyhound with suspected renal disease. **Objective:** The purpose of this study was to compare serum creatinine concentrations between Greyhound and non-Greyhound dogs. **Methods:** Thirty retired racing Greyhounds and 30 age- and gender-matched control non-Greyhound dogs were evaluated. Serum creatinine concentrations in both groups were measured using a standard biochemical method and compared statistically using a Kruskal-Wallis test. **Results:** Creatinine concentration was significantly higher in the Greyhounds ( $P < .01$ ) than in the control group. **Conclusion:** Greyhounds have a higher serum creatinine concentration than do non-Greyhound dogs. This idiosyncrasy should be taken into account when evaluating healthy Greyhounds and those with suspected renal disease. (*Vet Clin Pathol.* 2003;32:00-00)

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**Key Words:** Biochemistry, canine, creatinine, Greyhound, physiology, renal

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Greyhounds have been used at the Ohio State University Veterinary Teaching Hospital (OSU-VTH) as blood donors for over 2 decades. Many studies have been conducted showing hematologic differences between Greyhounds and non-Greyhound dogs.<sup>1,2</sup> Porter and Canaday<sup>1</sup> reported that mean RBC count, PCV, and MCHC in Greyhounds were significantly higher than those in mixed-breed dogs. They also reported higher serum sodium, chloride, and bilirubin concentrations and aspartate transaminase activity for the breed; in most cases, values were significantly higher. Sullivan et al<sup>2</sup> reported similar findings in Greyhounds, in addition to lower platelet counts than those in non-Greyhound dogs. Recently, Gaughan and Bruyette<sup>3</sup> reported that Greyhounds have significantly lower basal serum T4 and free T4 concentrations than do non-Greyhound dogs.

One of the OSU-VTH blood donor Greyhounds (a 2-year-old spayed female) was presented for evaluation of polyuria and polydypsia (PU/PD). A serum chemical profile revealed a creatinine concentration of 2.0 mg/dL (reference interval 0.6-1.6 mg/dL), and the dog had isosthenuric urine (specific gravity 1.013). This dog underwent extensive evaluation to determine whether there was underlying renal disease, but none could be found. The PD eventually was considered to be psychogenic and was managed accordingly. Several other blood donor Greyhounds had marginally high creatinine concentrations during their annual evaluations, which

prompted this study comparing serum creatinine concentrations in Greyhound and non-Greyhound dogs.

## Materials and Methods

The Greyhounds used in the study were blood donors and the property of the OSU-VTH; they were all retired healthy racers and were living in foster homes. The group consisted of 19 castrated males, 4 intact males, 5 spayed females, and 2 intact females. The mean age was 3.9 years (range 2-6 years). The Greyhounds were current on vaccinations, were serologically negative for *Dirofilaria immitis*, *Babesia canis*, and *Ehrlichia canis*, and were free of intestinal and external parasites. They were receiving either milbemycin (Interceptor, Novartis, Greensboro, NC, USA) or ivermectin (Heartgard, Merial, Iselin, NJ, USA) monthly for heartworm prophylaxis and were regularly treated for fleas with fipronyl (Frontline, Merial) and/or lufenuron (Program, Novartis). The control group was age- and gender-matched and consisted of apparently healthy non-Greyhound dogs that had normal CBC and serum biochemical profile results.

Blood samples were collected from the jugular or the cephalic vein and were placed immediately into vacuum tubes without anticoagulant (Vacutainer, Becton Dickenson, Rutherford, NJ, USA). The samples were allowed to clot, and the serum was separated immediately for analysis; samples were analyzed within 2 hours.

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Creatinine concentration was determined by the picric acid method using Boehringer Mannheim (Indianapolis, Ind, USA) reagents and a Hitachi 911 automated clinical chemistry analyzer (Boehringer Mannheim). Creatinine reference intervals in our laboratory had been established previously using 45 apparently healthy dogs of various breeds and all genders (intact and neutered males and intact and spayed females) ranging in ages from 1 to 10 years. The creatinine concentrations obtained in this study did not appear to be normally distributed based on the box and whisker plots (Figure 1) and other graphical representations of the data, so they were analyzed using the Kruskal-Wallis test.

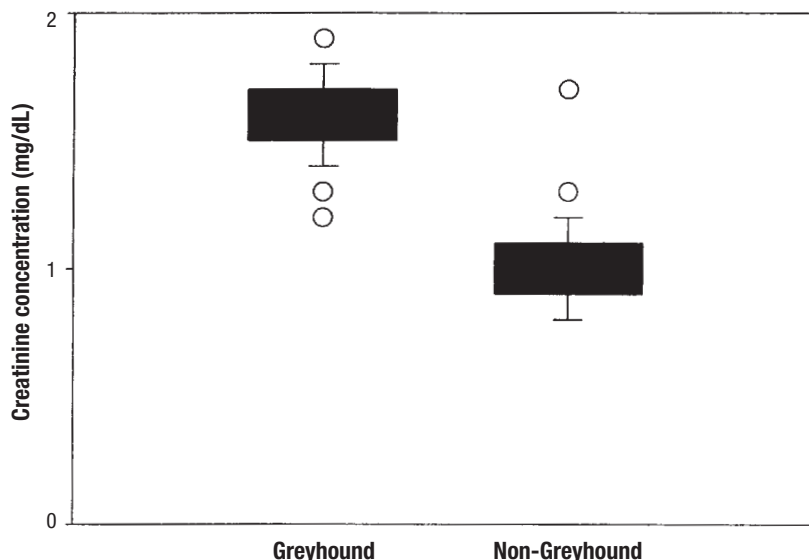
**Results**

The mean creatinine concentration in Greyhounds was significantly higher ( $P < .01$ ) than that in non-Greyhound dogs (Figure 1). The mean creatinine concentration in the Greyhounds was 1.6 mg/dL (median 1.6 mg/dL; range 1.2-1.9 mg/dL), and in 14 of 30 dogs the concentrations were above the reference interval established by OSU-VTH (0.6-1.6 mg/dL). The mean creatinine concentration in non-Greyhound dogs was 1.03 mg/dL (median 1.0 mg/dL; range 0.8-1.7 mg/dL), and in 1 of 30 dogs the concentration was above the reference interval established by OSU-VTH.

**Discussion**

Greyhounds have a unique physiology that can largely be attributed to their history as sight hounds and a racing breed. They have developed enlarged muscle mass, hemoconcentrated blood, lengthened carpal/tarsal and metacarpal/metatarsal bones, and a heightened sense of sight to help accommodate these evolutionary challenges.<sup>4</sup> These adaptations may have led to the many unique hematologic and biochemical characteristics of Greyhounds.

Phosphocreatinine is a chemical precursor to creatinine, which is found in high concentrations in muscle and is primarily eliminated by glomerular filtration.<sup>5</sup> Phosphocreatinine undergoes spontaneous cyclization, resulting in the loss of inorganic phosphate and the formation of creatinine. Animals with large muscle mass would therefore be expected to have higher body stores of phosphocreatinine, which could in turn result in higher serum creatinine concentrations. Racing Greyhounds are commonly fed diets containing animal tis-



**Figure 1.** Serum creatinine concentrations in Greyhound versus non-Greyhound dogs. The square in the center of the graph represents the median value. The upper and lower limits of the box represent the 25th and 75th percentiles. The whiskers represent the 10th and 90th percentiles.

sues rich in creatinine. Creatinine is well absorbed from the intestinal tract and could be a contributing factor to the high serum creatinine concentrations in active racers. However, the Greyhounds in this study had been retired from racing for periods of months to 2 years, so diet was probably not a factor in the high creatinine concentrations observed.

Greyhounds may have subnormal glomerular filtration rates (GFRs). However, because the Greyhounds in this study had the ability to concentrate urine (data not shown) and some of the dogs have been monitored for as long as 5 years since the first detection of a high creatinine concentration, a low breed GFR is not likely the cause of the high creatinine concentration in these animals.

Both Greyhounds and non-Greyhounds had serum creatinine concentrations outside of the reference interval. However, the number of Greyhound samples above the reference interval exceeded the number for non-Greyhounds (14/30 versus 1/30). The non-Greyhound who was outside of the normal reference range was likely a normal outlier, representing  $\leq 5\%$  of the population, as opposed to being "abnormal", since other laboratory test results were normal and the dog was clinically healthy.

The results of this study indicate that accurate interpretation of Greyhound creatinine concentration may be difficult in dogs with clinical signs compatible with renal disease, such as PU/PD and vomiting. Because these findings were obtained using healthy dogs, Greyhounds who are otherwise healthy and have mild-

ly increased creatinine concentrations do not seem to require any additional evaluation. A study comparing creatinine concentrations in active racing versus retired racing Greyhounds or American Kennel Club (nonracing) Greyhounds may help define the role of muscle mass and diet in the breed's biochemical profile. Moreover, evaluation of GFR in Greyhounds may shed light on whether this breed of dogs has normal renal function. ◊

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