REFERENCE INTERVAL AND CRITICAL DIFFERENCE FOR CANINE SERUM FRUCTOSAMINE CONCENTRATION

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ABSTRACT


The purposes of the study were to obtain a reference interval and to calculate the critical difference between two analytical results for canine serum fructosamine concentration. To obtain a reference interval, the serum fructosamine concentration was measured in blood samples from 29 adult dogs after a 15-h fasting period. To calculate the critical difference, blood samples from 20 apparently clinically healthy dogs were collected once weekly for five consecutive weeks, and the total variance of the analytical results was divided into the component of variance between dogs (S²inter), the component of variance for weeks within dogs (S²intra) and the component of variance for measurements (S²anal), using nested analysis of variance. The critical difference was then calculated from S²intra and S²anal.

The main conclusions are in summary: The reference interval for canine serum fructosamine concentration is 258.6-343.8 μmol/L, and the critical difference between two consecutive measurements on a week-to-week basis is 32.4 μmol/L. The critical difference may be used as a guideline to indicate potentially important changes in the serum fructosamine concentration, though the analytical results should not be assessed by the critical differences alone, but should also be compared to the corresponding reference intervals.

Keywords: dog, fructosamine, ketoamine, serum, variation

INTRODUCTION

Fructosamines are stable ketoamine compounds formed when glucose reacts non-enzymatically with amino groups on proteins. The fructosamine concentration is controlled by the balance between the rates of synthesis and removal. The rate of synthesis depends mainly on the plasma protein concentration and composition, and on the average blood glucose concentration over the circulatory lifetime of the plasma proteins. The removal rate apparently reflects the turnover rate of plasma proteins in general. Thus, the serum fructosamine concentration will increase with prolonged hyperglycaemia or prolonged hyperproteininaemia, but will fall with increased protein turnover, or prolonged hypoglycaemia (Bernstein, 1987). Hence, it has been suggested that measurement of serum fructosamine concentration could be an indicator of disturbances in protein or glucose metabolism, such as protein-losing gastroenteropathy in sheep (Heath and Connan, 1991), pregnancy toxaemia in sheep (Cantley et al., 1991) and diabetes mellitus in the dog (Jensen, 1992). A potential use for the serum fructosamine concentration in diabetes mellitus could be in long-term monitoring of
glycaemic control, which is necessary in order to reduce the severity of possible complications such as cataract formation, pancreatitis, hepatic lipidosis and ketoacidosis (Feldman and Nelson, 1987). Previously, long-term monitoring of glycaemic control in humans and dogs has been accomplished using glycated haemoglobin (Koenig et al., 1976; Bunn et al., 1978; Wood and Smith, 1980; Mahaffey and Cornelius, 1982; Smith et al., 1982; Peacock, 1984). The analytical methods involved are, however, either not commercially available or too elaborate and time-consuming for routine testing. The main difference between glycated haemoglobin and fructosamines is the length of their respective presence in the blood, which is about 120 days for haemoglobin compared to 8–10 days for serum fructosamine. Thus, owing to the shorter half-life, fructosamines could be used to evaluate the mean blood glucose concentration over a period of 1–3 weeks compared to 6–8 weeks using glycated haemoglobin (Willms and Lehmann, 1990).

In all of the above situations, the serum fructosamine concentration may be assessed in several ways, the most frequently used method probably being that of comparing the analytical result to a corresponding population-based reference interval. However, other ways of assessment may be used, one being that the patient serves as his own reference using comparison of analytical results from samples obtained serially at appropriate intervals. Consecutive analytical results may be compared using the critical difference \((d_k)\) (Stamm, 1982; Costongs et al., 1985), which can help to judge whether the difference between two consecutive analytical results can be safely ascribed to natural variation or is caused by other factors such as disease, therapy or experimental procedures. The present study reports a reference interval and the critical difference for canine serum fructosamine concentration on a week-to-week basis.

MATERIALS AND METHODS

Animals

Reference interval. Twenty-nine apparently healthy Beagle dogs (14 males and 15 females, aged 1–8 years) were used. The dogs had not been medicated for 14 days prior to the study, and they were fasted for 15 h prior to collection of the blood samples. Water was offered \textit{ad libitum} during the study.

Critical difference. Twenty Beagle dogs (10 males and 10 females, aged 1–6 years) were included in the study. They were all apparently clinically healthy prior to and during the study and they did not receive any medication for 14 days prior to and during the study. The dogs were housed in the usual kennels during the period of blood sampling. They were fasted for 15 h prior to each collection of blood samples. Water was offered \textit{ad libitum} during the study.

Sample collection

Reference interval. Blood samples were collected from each dog between 08.30 and 09.30 by puncture of the cephalic vein. On each collection, 5 ml of blood was collected