

Accuracy of Serum β -Hydroxybutyrate Measurements for the Diagnosis of Diabetic Ketoacidosis in 116 Dogs

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Study Design

- 116 diabetic dogs
 - 18 insulin-treated with a positive urine ketone test
 - 88 untreated, newly diabetic
- Dogs were assigned to 1 of 3 groups on the basis of laboratory findings
 - Diabetic ketoacidosis (DKA; n=43)
 - Hyperglycemia (serum glucose > 250 mg/dL) and glycosuria
 - Acidosis (plasma bicarbonate [HCO₃⁻] = 15 mmol/L) or acidemia (pH < 7.3)
 - Positive urine ketones
 - Diabetic ketosis (DK; n = 41)
 - Hyperglycemia and glycosuria
 - Lack of acidosis or acidemia
 - Positive urine ketones
 - Nonketotic diabetes (NKD; n = 32)
 - Hyperglycemia and glycosuria
 - Lack of acidosis or acidemia
 - Negative urine ketones
- Fifty healthy dogs were selected for the reference range study
 - All had serum glucose values within the reference range (80–120 mg/dL) and negative urine glucose and ketones

Results and Discussion

Table 1. Laboratory values of the diabetic dogs on admission.^a

	DKA (n = 43)	DK (n = 41)	NKD (n = 32)	Reference Values
β -OHB (mmol/L)	4.7 (2.0 to 20.2) ^b	2.1 (0.31 to 4.8) ^b	0.30 (0.01 to 1.3)	0.02 to 0.15
Venous blood pH ^c	7.228 (6.979 to 7.374) ^b	7.360 (7.300 to 7.435)	7.364 (7.301 to 7.452)	7.302 to 7.454
PCO ₂ (mmHg) ^c	27.9 (16.0 to 43.9) ^b	36.0 (26.6 to 44.8)	38.6 (28.0 to 48.2)	29.0 to 51.6
HCO ₃ ⁻ (mEq/L) ^c	10.1 (4.0 to 19.3) ^b	20.3 (15.1 to 27.0)	20.5 (16.0 to 26.1)	18 to 27
BE (mEq/L) ^c	-15.1 (-26.0 to -6.5) ^b	-3.7 (-9.0 to 3.1)	-3.2 (-7.8 to 1.0)	-5 to 2
Glucose (mg/dL)	493 (307 to 742)	502 (336 to 768)	536 (333 to 612) ^d	80 to 120
SUN (mg/dL)	58 (17 to 343) ^e	31 (15 to 71)	41 (13 to 219) ^d	17 to 48
AG (mEq/L)	25 (12 to 44) ^b	17.1 (10.2 to 26.4)	15 (4.9 to 22.9)	8 to 17
E _{OSM} (mOsm/kg)	316 (281.9 to 347.8)	321 (287.7 to 345.9)	320 (279.1 to 348.7)	300 to 315

- Serum B-OHB concentrations differed significantly ($P < .001$) among the study groups
- All dogs from the DKA and DK groups and 21 dogs from the NKD group had serum B-OHB concentrations above the upper limit of the reference values stated for this study (0.15 mmol/L)
- Serum B-OHB concentrations were higher in dogs from the NKD group in relation to healthy dogs ($P < .001$)
- The overall accuracy of the test was high (0.92)
 - This means that a randomly selected individual from the DKA group will have a serum B-OHB value greater than that of a randomly chosen animal from the DK group 92% of the time
- The cutoff value of 1.9 mmol/L showed the best sensitivity (100%, with specificity = 45%)
- The cutoff value of 3.8 mmol/L presented high specificity (95%, sensitivity = 72%) and a greater than 14 positive likelihood ratio

Key Points

- “... findings suggest that B-OHB determination may be a potential tool for diagnosing and monitoring ketoacidosis in diabetic dogs and therefore merits further study in the clinical setting”
- Considerable overlap between the DKA and DK groups may limit its use as a single laboratory index for the diagnosis of DKA with a simple cutoff value