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CANINE AND FELINE DIABETIC KETOACIDOSIS

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Diabetic ketoacidosis (DKA) is a serious complication of diabetes mellitus. Despite the expanding knowledge regarding the pathophysiology of DKA and the application of new treatment techniques for the complications, it remains a challenging disorder to treat. It is, in part, due to the deleterious impact that diabetic ketoacidosis has on multiple organ system and the frequent occurrence of concurrent often serious disorders that are responsible for the high mortality rate. Nevertheless, with logical therapy adapted to the individual and careful monitoring of clinical and clinicopathological parameters, the rate of therapeutic goal is high.

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EVALUATION OF ONE PORTABLE BLOOD GLUCOSE METER AND ONE PORTABLE GLUCOSE-KETONES METER IN CATS

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Numerous portable blood glucose meters (PBGMs) have been developed during the last decade, the majority of which is designed for use in humans. Recently one glucometer (Gluco Calea, WellionVet; GC) and one glucose-ketones meter (Belua, WellionVet; BE) have been developed for use in veterinary medicine. The aims of this study were to assess the accuracy and precision of these devices in feline venous and capillary blood samples based on ISO 15197:2013 and to evaluate packed cell volume (PCV) interferences.

Samples were obtained from 29 non anemic cats (PCV 30-47%) and 18 anemic cats (PCV<30%) divided into three glycemic ranges: high (>140 mg/dL), medium (90-139 mg/dL), and low (<90 mg/dL). Paired measurements of glucose and 3-ß-hydroxybutyrate (3-HB) from capillary and venous blood samples were determined using the two devices and compared with the results of reference methods (enzymatic hexokinase and 3-HB-dehydrogenase, respectively) obtained by an automated chemistry analyzer (Beckman-Coulter AU480). Linear regression, Bland Altman plots and the Parkes error grid analysis (EG) were used to assess the accuracy. PCV interferences for glucose measurement were assessed comparing the differences between PBGMs readings and reference method values in anemic and non-anemic cats. To assess within-run precision, glucose concentrations obtained from 14 samples, belonging to the three glycemic ranges, were measured 10 times within 10 minutes. Between-day precision was assessed by testing each manufacturer's glucose control solution over 10 consecutive days. P<0.05 was considered significant.

Mean differences (mg/dL) between measurements of each PBGM on capillary and venous blood and values measured by the reference method were: GC 30.7±35.4, 35.6.2±40.5, BE 15.5±35.5 and 15.0±24.1 respectively. A positive significant correlation between all paired samples was found for both devices (r>0.89). However neither PBGMs totally fulfilled ISO requirements, but 100% of glucose values measured on venous blood using BE fell in zone A+B of EG. Within-run and between-day precision were adequate. The effect of PCV was significant (higher results with lower PCV) only for BE.

The correlations between capillary and venous 3-HB and reference 3-HB were r=0.66 and r=0.82 respectively. Mean differences between capillary and venous 3-HB and reference method were -0.07 (±1.15) and -0.30 (±1.48) respectively; within-run precision was adequate.

Our results show that GC is not sufficiently accurate while the superior performances of BE supports its clinical use in cats.

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ACCURACY OF A FLASH GLUCOSE MONITORING SYSTEM IN DOGS WITH DIABETIC KETOACIDOSIS

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A factory-calibrated flash glucose monitoring system (FGMS) (FreeStyle Libre, Abbott, UK) was recently evaluated in stable diabetic dogs. The aims of this retrospective study were to assess the performance of the FGMS in dogs with diabetic ketoacidosis (DKA) and to determine the effect of body condition score (BCS), perfusion, severity of ketosis and acidosis on the accuracy of the device.

FGMS was placed in a clipped and clean area on the dorsal part of the neck of dogs with DKA within 14 hours from the presentation. The interstitial glucose measurements were compared with blood glucose (BG) measurements, obtained by a validated portable glucometer (Optium Xceed, Abbott, UK). Overall accuracy was determined by fulfillment of ISO 15197:2013 criteria, calculating mean absolute difference (MAD), mean absolute relative difference (MARD), median absolute relative difference (mARD), mean relative difference (MRD), percentage of results within ±15 mg/dL of the BG value for glucose <100 mg/dL and within ±15% of the BG value for glucose ≥100 mg/dL. Clinical accuracy was also illustrated using Parkes error grid and Bland-Altman plot. Sensor performance during changes in metabolic variables (lactate, β-hydroxybutyrate, pH and bicarbonate) was evaluated using Spearman's rank correlation.

Four hundred eighty-five paired results from 14 diabetic dogs with DKA were available for analysis. Good agreement between interstitial glucose measurements and BG was obtained (r=0.86; slope 0.88, intercept=18.37 mg/dL, r^2=0.72). Clinical accuracy of FGMS was demonstrated, with 63.9% of results in zone A and 99.8% of results in zones A and B (Fig. 1).

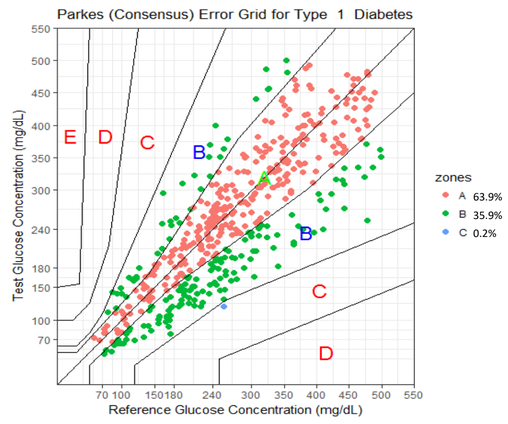

***Fig 1.** Parkes Consensus error grid analysis for the values obtained by FGMS and the representation with the percentage of values within zones.*
The reference glucose values on the x-axis are plotted against the blood glucose by the glucose meter (y-axis). The different zones designate the magnitude of risk derived from the determination: no effect on clinical action (zone A), altered clinical action: little or no effect on clinical outcome (zone B), altered clinical action: likely to affect clinical outcome (zone C), altered clinical action: could have significant medical risk (zone D), and altered clinical action could have dangerous consequences (zone E) (Parkes et al, 2000).

Overall MARD was 18.9%, mARD was 16.6%, MRD was -4.4%; the percentage of values within 15 mg/dL or ±15% was 48%. In the low glucose range, BG<100 mg/dL (n=26), MAD was 24.9 mg/dL; in the higher glucose range, BG≥100 mg/dL (n=459), MARD was 18.4%. Variations of lactate, β-hydroxybutyrate, pH and bicarbonate did not affect sensor performance. A significant interpatient variability in the accuracy of the device was observed (Kruskal-Wallis test, *P*<0.0001); FGMS tends to overestimate the glucose level in dogs with BCS≤3 and to underestimate in dogs with BCS≥7.

Despite the ISO 2013 requirements were partially fulfilled, FGMS provides clinically accurate estimates of BG in dogs with DKA. Accuracy of the system was apparently unaffected by metabolic variables making it suitable, not only for stable diabetic dogs, but also for dogs with DKA.

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