

EX VIVO SENSITIVITY AND ROBUSTNESS OF A NOVEL HOME SCREENING TEST FOR FELINE GLUCOSURIA



Key finding: The test adequately detects glucosuria at clinically relevant levels. The color remains stable for at least for 48 hours.

Introduction

Diabetic cats are late to exhibit visible clinical signs, and glucosuria is one of the first detectable signs of feline diabetes. A novel screening test for feline glucosuria has been developed. It consists of white, absorbent granules, which are sprinkled on mineral-based cat litter, turning blue when in contact with glucose-containing urine.

Objectives and hypothesis

- Hypothesis** The test can consistently detect clinically relevant glucosuria
- Objectives**
- determine the lower limit of detection for glucosuria
 - verify the product robustness in altered urine composition

Materials and methods

- Granules chromogenic reaction evaluation:** in triplicate, by applying 50 µL of glucose-fortified feline urine onto granules at glucose concentrations ranging from 0 – 1000 mg/dL.
- Different urinary compositions,** with various urinary specific gravities (USG), pH, proteinuria, ketonuria and hematuria.
- Time of reading:** coloration intensities noted at 5, 10, 20, 30, 60 minutes and at 2, 4, 8, 24 and 48 hours after exposure to the ex vivo-fortified urine.
- Color intensity of the chromogenic reaction** (Fig. 1): scored with an ordinal visual scale from 0 (none) to 3+ (intense)



Figure 1: Chromogenic intensity scale

- Variables verification/measurement methods:**
 - glucosuria: chemistry analyzer (DxC600®, Beckman Coulter)
 - urinary pH: pH-meter (Hi 2222®, Hanna Instruments)
 - USG: refractometer (Reichert VET 360®)
 - ketonuria: urinary strips (Chemstrip9® Roche Diagnostics)
 - hematuria: microscopic evaluation
- Data analysis:** mixed logistic regression model for repeated measures, taking into account glucosuria, time, USG, pH, proteinuria, ketonuria and hematuria.

Results

- Lower limit of detection (LLD): **20mg/dL** (1,1mmol/L).
- Appearance of chromogenic reaction usually between 1 and 3 minutes** after contact with glucosuria. LLD significantly increased with the time of reading, i.e. LLD = 30-50 mg/dL at 48 hours; p-value < 0.05 (Table 1).

Glucosuria (mg/dL)	0	20	30	50	75	100	300
Granules score 10 min	0	1+	2+	2+	3+	3+	3+
Granules score 30 min	0	1+	1+	2+	3+	3+	3+
Granules score 24h	0	0	1+	2+	3+	3+	3+
Granules score 48h	0	0	1+	2+	3+	3+	3+

Table 1: Chromogenic responses of the granules (over 48 hours), urinary sample with SG=1,013, pH=6.

- LLD significantly increased with:
 - increasing pH (i.e. LLD = 100 mg/dL at pH ≥ 8.2; p-value < 0.0001),
 - USG (i.e. LLD = 100mg/dL at USG ≥ 1,060; p-value < 0.0001),
 - High proteinuria (i.e. LLD = 100 mg/dL at proteinuria ≥ 5g/L; p-value < 0.0001).
- No significant effect of ketone bodies and hematuria on the reactivity (p-value > 0.05).

Discussion

- Relevance of this test:**
 - Diabetes mellitus (DM) is one of the most common feline endocrinopathies, occurring in an estimated 0.4%–0.7% of cats^{1,2,3,4}, with evidence that this prevalence is increasing^{3,4}.
 - Glucosuria is one of the first clinical signs of DM^{1,2}.
 - Relevance of an early diagnosis of DM¹ and relevance of urine glucose measurement in the monitoring of DM⁵
- Relevance of this limit of detection:**
 - Mean glucosuria among DM cats = 864mg/dL⁶,
 - Mean glucosuria among healthy cats ≤ 7mg/dL⁶,
 - Glucosuria > 25mg/dL is considered as pathologic⁶.
- With a reading at 48 hours, the granules detect as low as 30-50mg/dL, over the pathological limit and far below DM cats mean glucosuria levels.
- Limits of this study:** ex vivo controlled conditions. Parallely presenting a test in clinics and households with feline patients.

Conclusion

- The test adequately detected glucosuria at clinically relevant levels and is suitable for both clinical and household trials.

Literature cited

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