

Comparative evaluation of a new point-of-care blood electrolyte analyzer in the veterinary sector

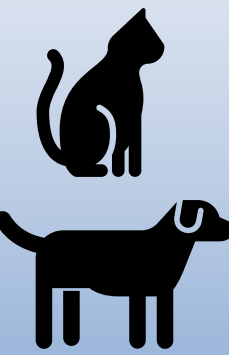
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Introduction



Electrolyte monitoring is vital in companion animal medicine for characterizing and managing metabolic, gastrointestinal, renal, and endocrine disorders.



Access to a point-of-care (POC) blood electrolyte analyzer that is simple to use and generates rapid results is vital for the diagnosis and treatment of patients in the veterinary emergency and critical care (ECC) setting.

Aims

To evaluate the performance a new direct ion-selective electrode point-of-care blood electrolyte analyzer (EXIAS e|I^{vet}) and compare it with other market-leading veterinary electrolyte analyzers to verify its accuracy, reliability and consistency.

Methods

Eligibility criteria

- ✓ Cats and dogs
- ✓ Both healthy and sick animals

Recruitment

Informed owner consent was obtained for the recruitment of n=69 animals into the study from a primary care veterinary practice (Phoenix Vets, Loughborough, UK).

Data collection

- Residual blood samples that had been drawn either for pre-anaesthetic screening or for diagnostic purposes were analyzed by the EXIAS e|I^{vet} blood electrolyte analyzer.
- EXIAS e|I^{vet} analyzed levels of Na, K, Cl, iCa, pH and HCT in lithium heparin uncoagulated whole blood.
- Results were compared against two predicate methods: the Siemens epoc Blood Analysis System and IDEXX Catalyst One Chemistry Analyser (Na, K and Cl only).

Analysis

- Comparison of specimens analyzed in accordance with CLSI EP09c and EP21 2nd Edition consensus protocols for assessing bias between two measurement procedures using paired patient samples, with Grubb's test used to identify outliers.
- Agreement between blood analyzers assessed via bias estimation and Deming regression analysis, with acceptance criteria based on allowable total error calculated nonparametrically in accordance with EP21 2nd Edition.
- Accuracy >95% represented a validated level of agreement between the EXIAS e|I^{vet} and the predicate method.

Direct ion-selective electrode sampling of whole uncoagulated blood with results in 25 seconds



Results

Animals

Total of 45 dogs and 24 cats, aged from 1 to 20 years, both sick and healthy undergoing screening.

Comparison between EXIAS e|Ivet and predicate methods

- Validated level of agreement between epoc and EXIAS e|I^{vet} in the measurement of all parameters.
- Validated level of agreement between Catalyst One and EXIAS e|I^{vet} in the measurement of K and Cl
- EXIAS e|I^{vet} measurement of Na at 85.1% accuracy when compared with Catalyst One, similar to the level of agreement seen between Catalyst One and epoc.

Comparison (x vs y)	Analyte	Range	Accuracy	R ²	Mean bias	Verdict
EPOC vs EXIAS	Na	130-156 mmol/L	98.6%	0.747	-0.471	Pass
	K	2.3-5.3 mmol/L	100.0%	0.976	+0.118	Pass
	Cl	96-130 mmol/L	95.5%	0.814	-5.68	Pass
	iCa	0.97-1.45 mmol/L	100.0%	0.713	+0.014	Pass
	HCT	22-71 HCT%	100.0%	0.971	+1.74 HCT%	Pass
CATALYST vs EXIAS	pH	7.192-7.548	98.4%	0.899	-0.038	Pass
	Na	133-161 mmol/L	85.1%	0.785	-4.33	Fail
	K	2.6-5.2 mmol/L	100.0%	0.903	-0.107	Pass
CATALYST vs EPOC	Cl	93-124 mmol/L	100.0%	0.886	+0.221	Pass
	Na	133-161 mmol/L	88.1%	0.731	-3.88	Fail
	K	2.6-5.2 mmol/L	95.5%	0.837	-0.244	Pass
	Cl	93-124 mmol/L	84.4%	0.747	+5.81	Fail

Table 1. Level of agreement between EXIAS e|I^{vet}, epoc and Catalyst One. Accuracy goal of 95% achieved across all parameters between EXIAS e|I^{vet} and epoc, and with K and Cl between Catalyst One and EXIAS e|I^{vet}. Accuracy goal of 95% only achieved with Cl between epoc and Catalyst One (n=69)

Bland-Altman difference plots

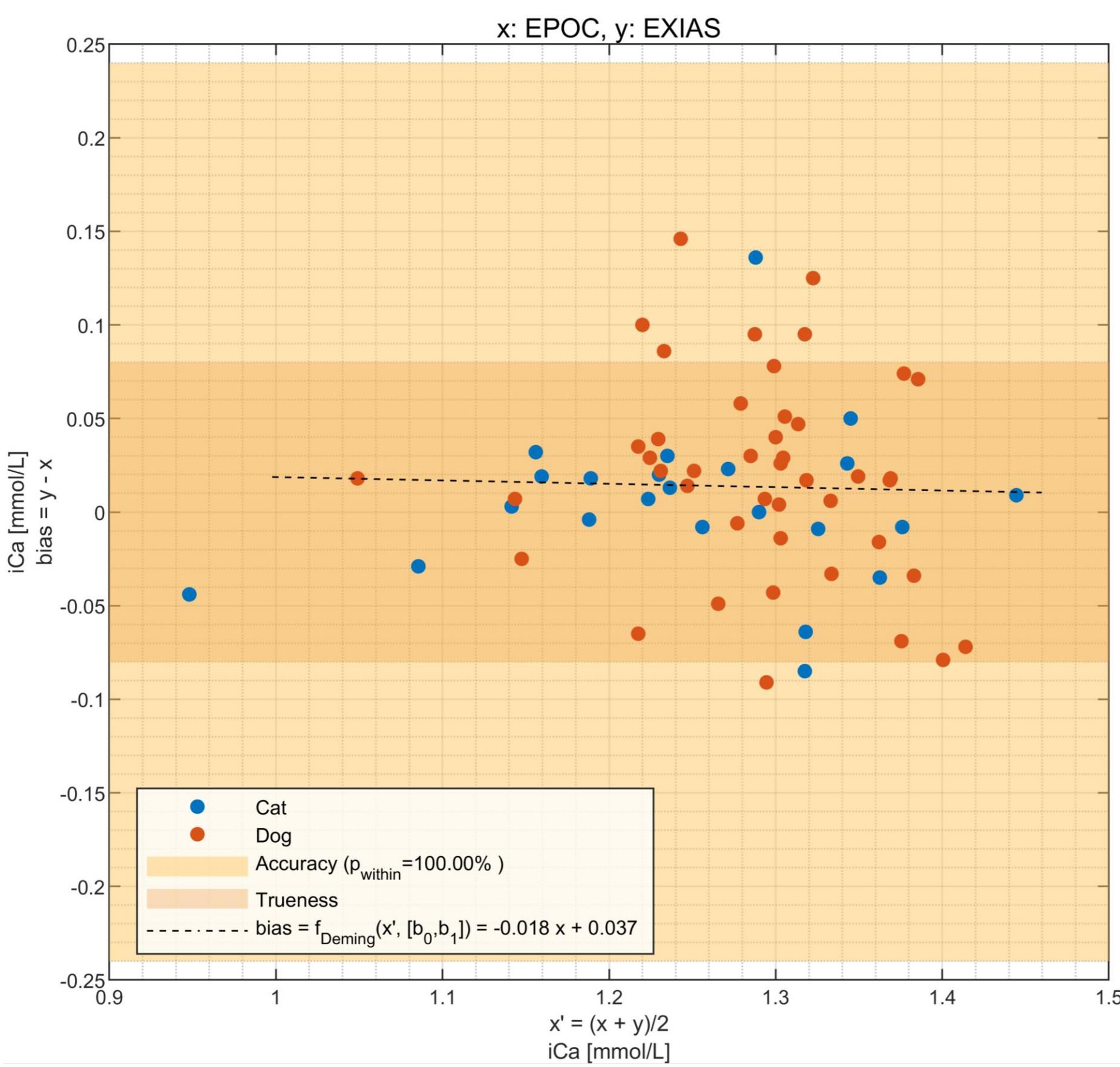


Figure 1. Bland–Altman analysis demonstrating the agreement between measurements of iCa by the epoc and EXIAS e|Ivet

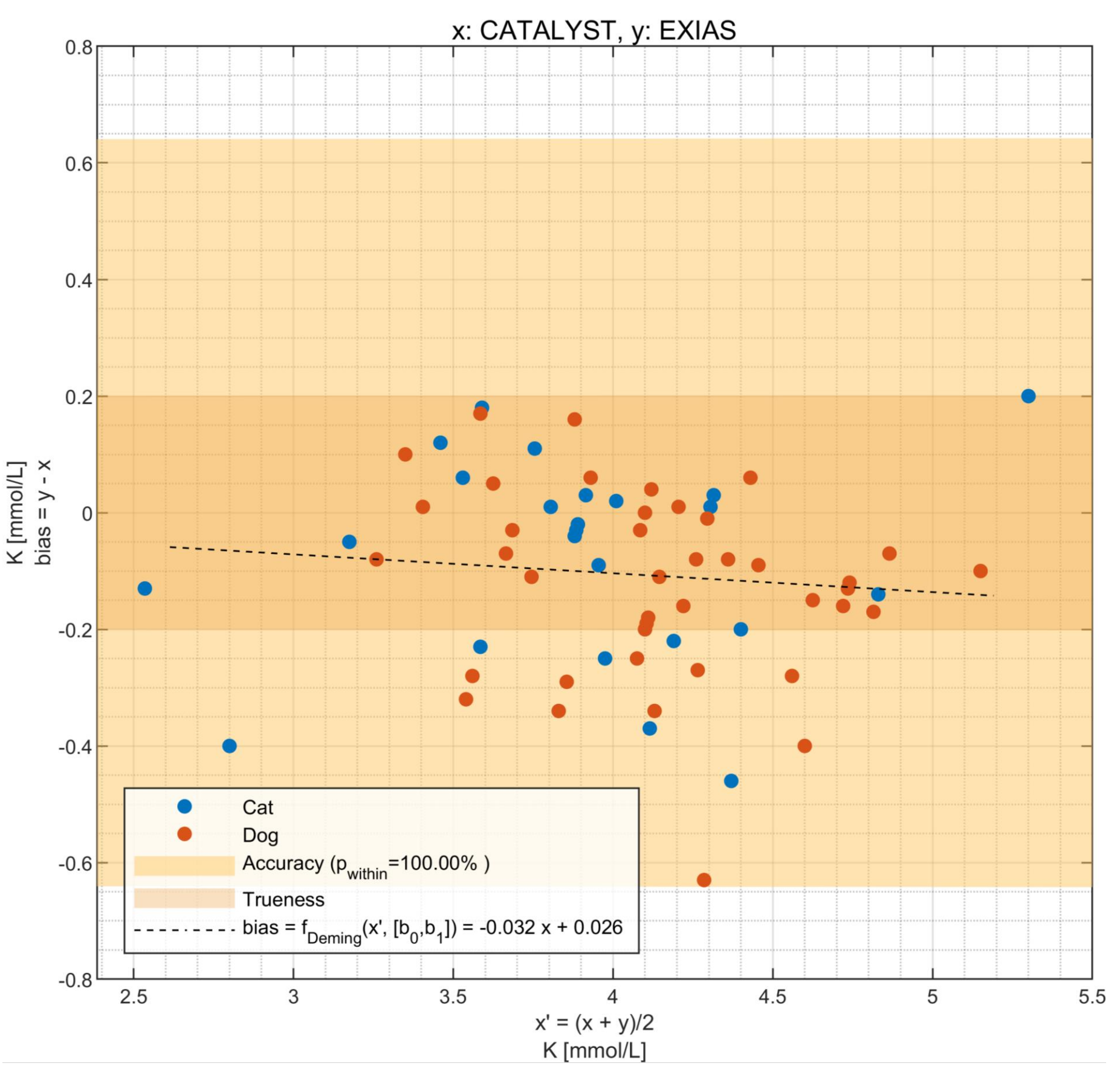


Figure 2. Bland–Altman analysis demonstrating the agreement between measurements of K by the Catalyst One and EXIAS e|Ivet

Discussion

- Minimizing blood volumes required for analysis is vital in critically ill patients (Brown & Drobatz, 2019). The blood volume required for analysis by the EXIAS e|I^{vet} was 20 microliters of blood, compared with 100 microliters for the epoc and 700 microliters for the Catalyst One.
- The ability to rapidly measure electrolytes in the ECC setting is crucial (Boag, 2019). The time to display of results was 25 seconds for the EXIAS e|I^{vet}, compared with 40 seconds plus a 165 second calibration for the epoc and 600 seconds for the Catalyst One.

Acknowledgements

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Conclusions

- The EXIAS e|I^{vet} is a highly accurate blood electrolyte analyzer, demonstrating comparable to superior accuracy when compared with the predicate methods.
- The EXIAS e|I^{vet} generates results faster and requires less blood volume than the predicate methods.
- The EXIAS e|I^{vet} therefore represents an excellent solution for electrolyte monitoring in small animal veterinary practice.

References

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Ethical approval for this study was granted by the University of Nottingham Ethics Committee (no. 4534 191125).