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Safety and Health Research

Electrolyte quantification in the aqueous and vitreous humor of common preclinical species

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INTRODUCTION

The assessment of ocular health in support of standard preclinical ocular examinations has generated interest in ocular toxicology testing. Few studies have quantified the clinical chemistry contents of aqueous and vitreous humors across species. The goal of this study was to quantify the electrolyte composition of aqueous and vitreous humors across four standard preclinical species.

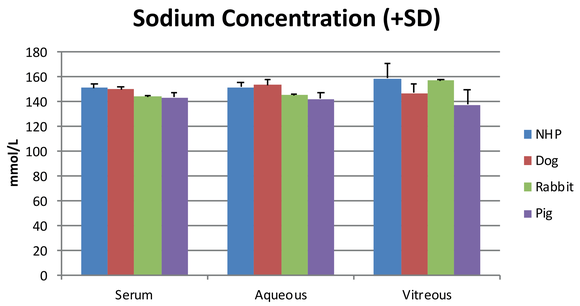
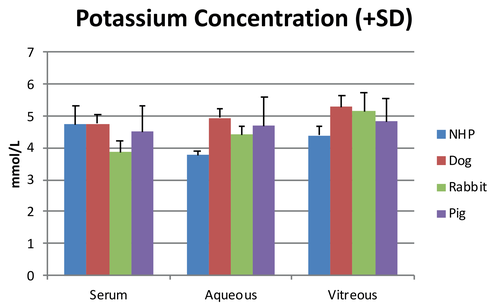
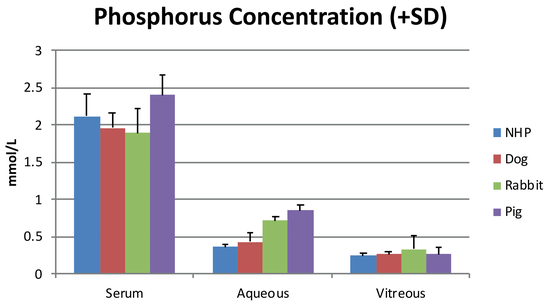
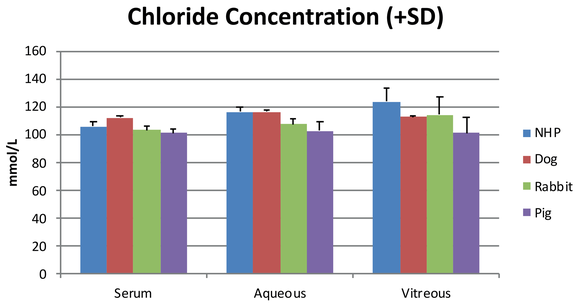
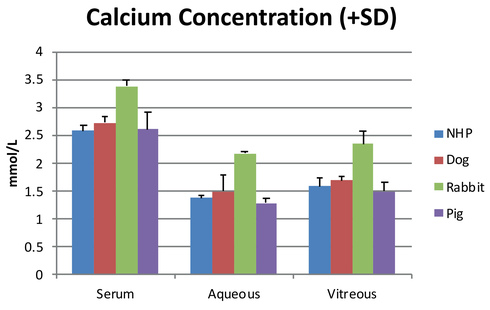
METHODOLOGY

Aqueous and vitreous humors were collected from rabbits (n=7), dogs (n=9), monkeys (n=10) and minipigs (n=13). Intra-species age and body weight ranges were comparable. Prior to collection, the animals were deeply anesthetized and all eyes received 0.5% proparacaine topically, followed by a 10 mL flush with physiological saline. Vitreous humor (targeted 0.2 mL) was then collected using a standard 5-mL syringe with a 25G needle and aqueous humor (targeted 0.2 mL) was collected using a standard 1-mL syringe with a 30G needle. Following collection, the eyes were treated with 0.3% Ciloxan antibiotic and a bland ophthalmic lubricant was applied to protect the corneas during recovery. Vitreous and aqueous humors were transferred into plain tubes and placed on wet ice pending analysis. Due to their viscosity, samples were diluted with sterile water (1:2) or as needed. Electrolyte contents of the vitreous and aqueous humors were analyzed by a Cobas® 6000 module c501 Chemistry Analyzer set to plasma/serum mode. Parameters are expressed in mmol/L.

RESULTS

The rank order of electrolyte concentrations in both aqueous and vitreous humors across the four species was sodium, chloride, potassium, calcium and phosphorus. Sodium and chloride concentrations were generally higher in aqueous and vitreous samples across species when compared to calcium, potassium and phosphorus. For each species, electrolyte concentrations were generally comparable between their respective aqueous and vitreous humors, with the exception of phosphorus, where the aqueous-electrolyte concentration was slightly higher than vitreous humor levels. Most notably in the rabbit and pig. Vitreous and aqueous humor concentrations of sodium, potassium and chloride were generally similar to species-specific serum levels; however, phosphorus and calcium concentrations were slightly below serum levels.

CONCLUSION

- This study provided a baseline/reference of vitreous and aqueous humor electrolytes. Electrolyte measurement from aqueous and vitreous humor could be a useful parameter in the assessment of ocular toxicity in toxicology studies. The electrolyte composition of these anatomical segments may also have implications relative to test compound chemistry following intra-ocular delivery.

Species	Matrix	n	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Calcium (mmol/L)	Phosphorus (mmol/L)
NHP	Aqueous	8	152.00 ± 3.21	3.78 ± 0.11	116.08 ± 3.24	1.37 ± 0.06	0.36 ± 0.04
	Vitreous	10	159.00 ± 12.16	4.40 ± 0.27	123.90 ± 9.57	1.59 ± 0.16	0.24 ± 0.03
	Serum	169	151.00 ± 3.10	4.73 ± 0.60	106.00 ± 3.20	2.58 ± 0.10	2.12 ± 0.30
DOG	Aqueous	9	153.67 ± 4.58	4.93 ± 0.28	116.40 ± 2.97	1.50 ± 0.28	0.43 ± 0.13
	Vitreous	7	146.86 ± 7.82	5.30 ± 0.36	112.74 ± 6.83	1.70 ± 0.07	0.27 ± 0.02
	Serum	178	150.00 ± 2.00	4.77 ± 0.30	112.00 ± 2.00	2.73 ± 0.10	1.96 ± 0.20
RABBIT	Aqueous	7	145.29 ± 3.20	4.42 ± 0.27	107.46 ± 3.91	2.18 ± 0.04	0.72 ± 0.05
	Vitreous	7	157.00 ± 17.58	5.15 ± 0.57	113.97 ± 12.64	2.34 ± 0.25	0.33 ± 0.19
	Serum	208	143.88 ± 2.91	3.86 ± 0.38	103.11 ± 2.59	3.38 ± 0.11	1.89 ± 0.33
PIG	Aqueous	13	142.54 ± 4.36	4.69 ± 0.90	102.76 ± 6.46	1.29 ± 0.09	0.85 ± 0.08
	Vitreous	11	137.82 ± 12.25	4.84 ± 0.73	100.95 ± 11.48	1.50 ± 0.15	0.26 ± 0.09
	Serum	200	143.46 ± 3.71	4.50 ± 0.81	100.88 ± 2.76	2.61 ± 0.31	2.40 ± 0.28