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## COMPARISON OF CANINE PLASMA SODIUM AND POTASSIUM DETERMINATION WITH THE ECS 2000 ION-SELECTIVE ELECTRODE ANALYZER AND VITROS 250.

### INTRODUCTION

The measurement of plasma / blood sodium and potassium concentrations is one of the most frequently performed laboratory analysis in clinical chemistry. In emergency and critical care settings, it must be performed rapidly with readily available equipment, which can be used by untrained personnel, when the specialized technicians are not on duty.

Most ion-selective electrode analyzers currently available are expensive machines, requiring careful use by trained personnel. Recently commercialized new equipment, the ECS 2000 (SM Diagnostics, Chennai, India) is a robust, inexpensive, easy-to use ion-selective electrode analyzer performing only sodium and potassium analyses in whole blood, plasma, serum or urine. The aim of this study was to test its accuracy by comparing results obtained with this analyzer and a Vitros 250 (Ortho Clinical Diagnostics, Issy les Moulineaux, France) in canine plasmas.

### MATERIALS AND METHODS

Canine whole blood and plasma have been analyzed at the Laboratoire Central d'Analyses Biologiques of the Veterinary School of Toulouse. The Li-heparine plasmas were first analyzed using a Vitros 250 ; the accuracy of this system is controlled weekly with Verifier I et II solutions (Ortho Clinical Diagnostics, Issy les Moulineaux, France) and the results are validated only when these control are satisfying. The analyzing performances of Vitros 250 are reported in Table I. Seventy-one plasmas were stored at +4°C up to 6 hours, then analyzed with ECS 2000. This machine is calibrated on a point with a calibration solution provided by the manufacturer (Calset Calibrator). The measurements are performed by pouring 200 µL of sample in a small cup and triggering the analysis, which lasts about 1 minute. Then the result is displayed on a screen or can be printed. The analyzing performances indicated by the manufacturer are compared to the Vitros in Table I.

Table I		Sodium			Potassium		
Usable range	ECS2000	10-999 mmol/L			0.2-300.0 mmol/L		
	Vitros 250	75.0-250.0 mmol/L			1.00-14.00 mmol/L		
Precision (CV, %)	ECS 2000	low	normal	high	low	normal	high
		0.7	0.5	0.5	0.4	0.6	1.1
	Vitros 250	124 mmol/L	147 mmol/L		3.0 mmol/L	5.6 mmol/L	
		0.9	1.0		1.6	1.9	
Reference values Vitros 250	138-148 mmol/L			3,5-5,0 mmol/L			

The comparison between plasma and whole blood was performed with the ECS 2000 on 36 samples. The Calset Calibrator was used as a sample to test the precision of the machine. The results were compared using the usual methods (Passing-Bablok regression, bias plots, paired t-test, Spearman rank correlation). The comparison also concerned the medical interpretation based on the reference values indicated by the Vitros' manufacturer (Table I).

## RESULTS

The day-to-day precision was evaluated on 22 runs of the Calset Calibrator ; CVs were 1,2 % for sodium and 1,6 % for potassium, at mean concentrations of 180,5 mmol/L and 7,95 mmol/L respectively. A global comparison of the 2 analysers, shows a good agreement (Table II), although the results were statistically different for sodium and potassium (paired t-test,  $P < 0,001$ ).

The scatterplots (Figure 1) and the bias plots (Figure 2) show that the correlations between the 2 series of results are excellent for potassium ( $r = 0,96$ ) and good for sodium ( $r = 0,79$ ). The bias was proportionnal for sodium, from -0,57 to -4,93 mmol/L and for potassium, from 0,11 to 0,44 mmol/L (Student's test,  $P < 0,05$ ).

Table II	Sodium			Potassium		
	Vitros	ECS	Difference	Vitros	ECS	Difference
Mean	145,0	147,4	-2,4	4,15	4,00	0,15
Median	145	148,5	-2,8	4,0	4,0	0,1
SD	4,49	5,22	2,93	0,841	0,732	0,183
Minimum	131	132	-7,0	2,5	2,45	-0,15
Maximum	155	157,5	7,0	7,7	6,75	0,95

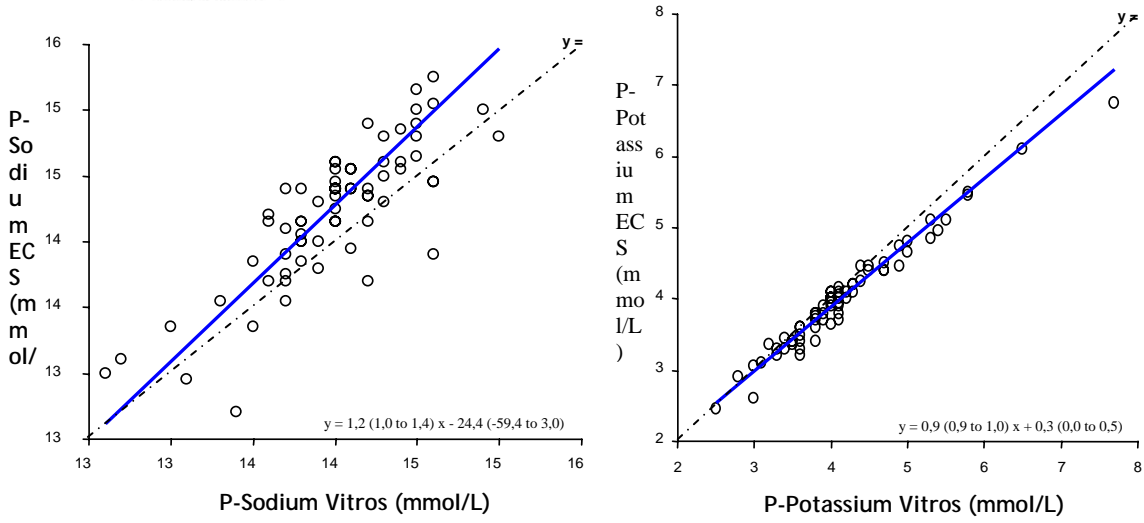
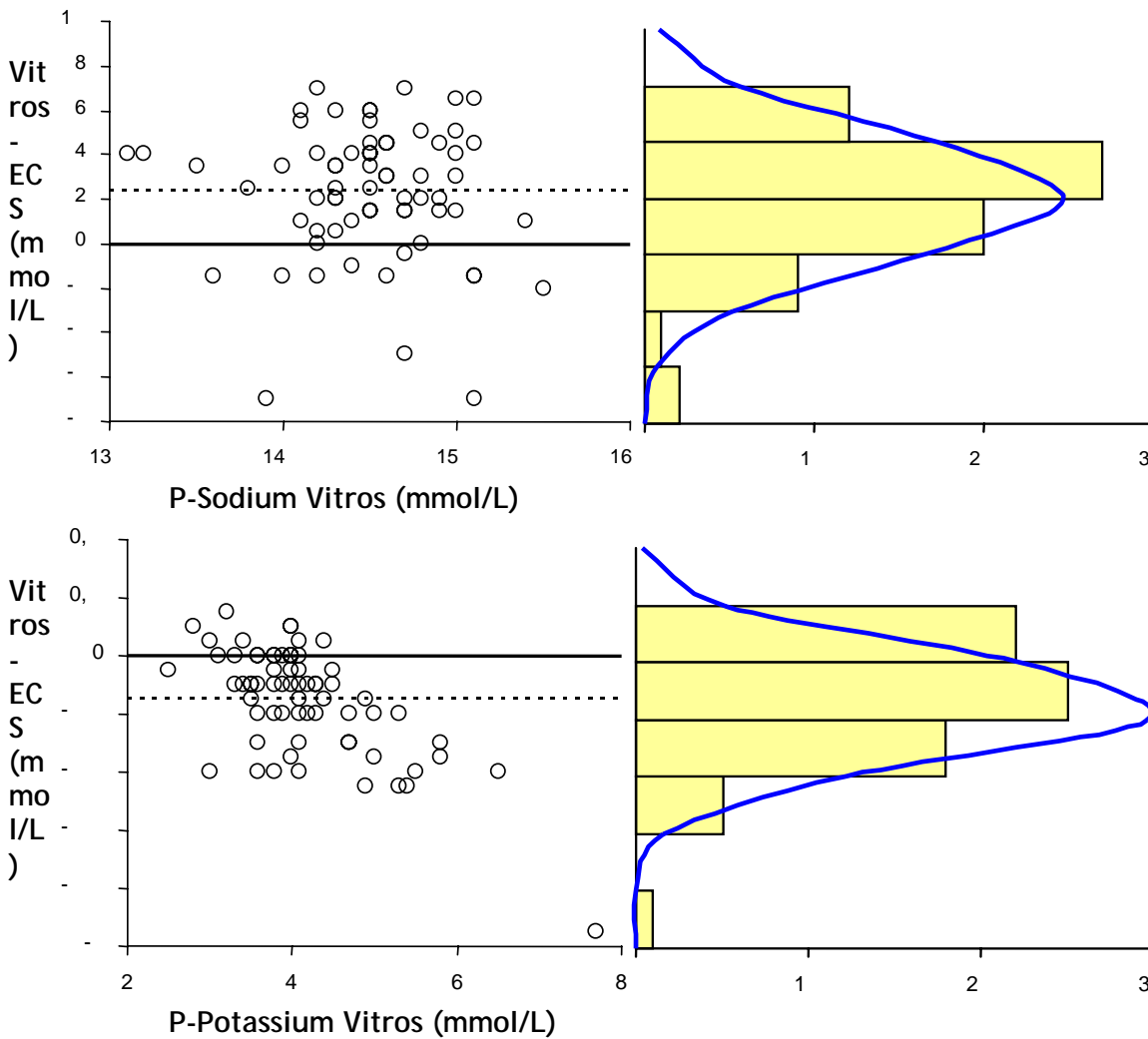


Figure 1 : Scatterplots, Passing-Bablok regression

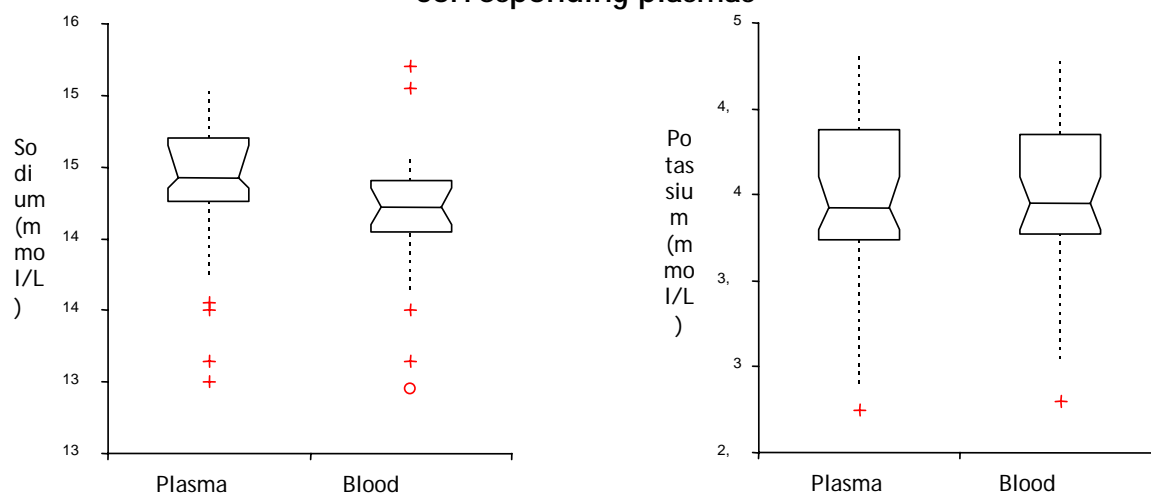


The clinical discrimination « normal » vs. « high » or « low » according to the Vitros reference intervals, showed that 94 % of the results for sodium and 90 % of the results for potassium fell into the same categories.

The comparison of the results obtained in whole blood and plasma showed an excellent agreement between the 2 series (Figure 3 and Table 3). The differences between the 2 series were significant for sodium (paired t-test,  $P < 0,01$ ) but not for potassium. Only 4 and 2 differences between whole blood and plasma were clinically significant for sodium and potassium respectively.

Table III	Sodium			Potassium		
	Plasma	Blood	Difference P-B	Plasma	Blood	Difference P-B
Mean	148,8	146,7	2,0	3,95	3,97	-0,02
Median	149,3	147,3	1,8	3,93	3,95	-0,02
SD	4,96	4,33	1,91	0,520	0,486	0,115
Minimum	135	135	-2	2,8	2,8	-0,3
Maximum	156	157	6,5	4,8	4,8	0,4

Table III & Figure 3 : Comparison of ECS results in 36 canine blood samples and corresponding plasmas



## DISCUSSION AND CONCLUSION

Routine measurement of sodium and potassium is most frequently performed with ion-selective electrodes, emission spectrometry (which is the reference method) or enzymatic techniques. The Vitros 250 and the ECS 2000 both use direct potentiometry and should give similar results even in hyperlipemic samples. According to the human medicine recommendations, the total error should not exceed  $\pm 4$  mmol/L for sodium and  $\pm 0,5$  mmol/L for potassium in medium level samples. During our assay, the precision of the ECS 2000 was very satisfying (CVs  $< 2\%$ ), although the manufacturer's data were mildly inferior.



Despite the small number of samples, the concentrations measured were representative of routinely observed values, thus allowing valid statistical comparisons. Our results showed a very good agreement between the measured values with the two analysers for potassium and a good agreement for sodium. Although the differences between the results were statistically significant, the bias was inferior to the total allowable error in most samples.

An important point is that the 2 analysers would allow an identical clinical interpretation of results as normal vs abnormal with less than 7% discrepancies. The comparison between whole blood and plasma showed that the results were not different; centrifuging the sample does not improve the analytic quality, which saves a precious time especially in emergency and critical care settings.

As a conclusion, the ECS 2000 gives very good results. Quick and easy to use, it is a good alternative to more expensive analysers for veterinary clinics.