Evaluation of the Sysmex XT 2000iV haematology instrument for use with feline blood

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Introduction

The objective of this study was to evaluate the Sysmex XT 2000iV with respect to its use in the feline species; especially the results of reticulocyte (RET) and platelet (PLT) count were of great interest: Inaccuracy for feline PLT count is a common problem with many haematology analyzers, and RET count has not been automated so far.

Materials and Methods

This evaluation was based on the analysis of 409 cat blood samples that were collected by venipuncture, regardless of sex, age or breed, in the small animal internal medicine and surgical clinic of the Vetsuisse Faculty, University of Zurich. The Sysmex XT 2000iV is a flow cytometer which analyzes 31 parameters and is based on the principles of multi-angle polarised light scatter separation for WBC, WBC differential, RET and PLT-O. The impedance method is used to determine RBC and PLT-I, and HGB is measured by using the SLS (sodium lauryl sulfate) method. Reference methods used were according to the International Committee for Standardization in Haematology (ICSH) recommendations. They included centrifugal haematocrit, CellDyn® 3500 analyzer for RBC, red cell indices, WBC and HGB, microscopic differentiation of 200 WBC (100 cells each by 2 technicians) and manual RET as well as PLT count.

Results

Precicion in series

Parameter	CV %
WBC x10^3/µl	0.92-1.98
NEUT x10^3/µl	1.52-3.55
NEUT %	0.56-2.67
LYMPH x10^3/µl	1.96-8.16
LYMPH %	2.1-7.77
MONO x10^3/µl	3.95-21.23
MONO %	4.2-21.76
EOS x10^3/µl	5.03-10.01
EOS %	5.07-10.62
BASO x10^3/µl	9.42-26.65
BASO %	9.5-26.65
RBC x10^6/µl	0.41-1.06
HGB g/dl	0-0.69
HCT %	0.28-0.88
MCV fl	0.27-0.76
MCH pg	0.48-1.18
MCHC g/dl	0.41-1.28
RET x10^3/µl	6.36-6.81
RET %	6.44-6.8
LFR %	2.11-3.28
MFR %	28.7-44.2
HFR %	30.4-88.1
IRF %	27.4-4697
PLT-Ox10^3/µl	1.35-4.57
PLT-I x10^3/µl	1.92-43.63

Clinical relevance

Parameter	Correctly recognized samples/evaluated samples			not correctly recognized samples	
	< reference range	Within reference range	> reference range	with no clinical relevance	with possible clinical relevance
RBC	117/120	264/268	20/21	8	-
HGB	185/1:8	211/215	6/6	7	-
HCT	172/185	185/219	5/5	43	3
MCV	144/144	166/244	17/21	80	2
RET #	-	33/61	37/39	2	28
RET %	-	22/49	50/51	5	23
IRF #	-	61/61	11/39	3	25
IRF %	-	49/49	24/51	0	27
PLT	44/46	42/53	0/1	7	7
WBC	23/28	236/255	124/127	20	6
LYMPH	43/62	118/126	5/5	7	20
MONO	0/11	136/159	30/31	4	31
NEU	8/11	116/118	60/64	4	5
EOS	42/61	96/109	29/38	13	28

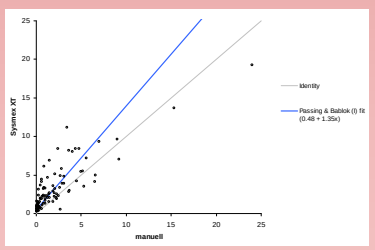
Accuracy

Parameter	Coefficient of correlation r	Intercept a	Slope b	Significance of differences of methods[a]
WBC	0.98	-0.07	1.05	<0.0001
NEUT #	0.98	0.16	0.98	0.9277
LYMPH #	0.92	0.1	1.12	<0.0001
MONO #	0.65	0.02	1.42	<0.0001
EOS #	0.87	0.04	0.97	0.002
BASO #	-0.03	0.0	0.57	0.4391
RBC	0.99	-0.05	1.01	0.17
HGB	0.99	-0.87	1.08	0.4414
HCT	0.97	-1.35	1.05	0.001
MCV	0.95	-14.88	1.32	<0.0001
MCH	0.95	0.58	0.96	0.0004
MCHC	0.42	-68.58	3.06	<0.0001
RET #	0.73	14606	1.52	<0.0001
RET %	0.85	0.48	1.35	<0.0001
IRF #	0.75	1323	0.28	<0.0001
IRF %	0.85	0.02	0.29	<0.0001
PLT	0.95	-0.89	0.96	0.0683

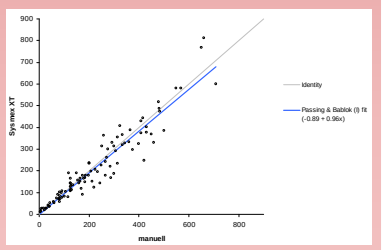
Linearity

Parameter	Coefficient of correlation	Tested range of linearity	Reference range according to the Sysmex XT
WBC	0.99	0.05-15.5 x 10^3/µl	0-310 x 10^3/µl
RBC	0.99	0.18-19.6 x 10^6/µl	0-14 x 10^6/µl
HGB	0.99	0-29.1 g/dl	0-25 g/dl
HCT	0.99	0-82%	0-70%
RET	0.96	0-98.2 x 10^3/µl	0-3 x 10^6/µl
PLT	0.99	0-4140 x 10^3/µl	0-2000 x 10^3/µl

RET



PLT



Discussion

Good precision was achieved for the measurements of all RBC parameters, with the exception of reticulocytes. The platelets measured in the optical method showed good to acceptable precision depending on the amount of PLT present in the sample.The rather high CVs of EOS and BASO can be explained by the low mean values and can not be attributed to the measurement system. From the observation that all measured parameters showed no deviation of linearity over the tested range, it was concluded that the linearity within, above and below the reference ranges is excellent. Good to very good correlation between the Sysmex XT 2000iV and those of the reference methods was observed for WBC, NEUT, LYMPH, RBC, HGB, HCT, MCV, MCH and PLT. Acceptable correlation was received for EOS and RET. The correlation for monocytes and basophils was less satisfactory, mainly because the precision of low cell counts is low in microscopy. The wide majority of all results obtained by the Sysmex XT 2000iV would have led to the same clinical interpretation as the results from the reference methods, however, in much faster time.

Conclusion

The Sysmex XT 2000iV was found to be highly suitable for use with feline blood. The results of 31 haematological parameters are obtained with little effort within one minute. Results for WBC, NEUT, LYMPH, EOS, RBC, HGB, HCT, MCV, MCH, PLT and RET show a high degree of reliability. According to the evaluation of the clinical relevance of the results provided by the Sysmex XT, it was found that occasionally lymphocytopenias and monocytopenias may be missed. In cases where no clear evaluation of a sample is possible, this is indicated by a message code. By analyzing the scattergram, these deviations may be recognized, however. Presence of an extension of the neutrophils towards the lymphocyte population was found to be a reliable parameter for the presence of immature neutrophils in the blood sample, a fact that is highly useful for the clinical interpretation (Mathy and Koepke 1974).

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