

Haematology Analyser - Instructions for Use

Switch On (at rear of Analyser) and wait for startup process to finish.

(A high pitched sound and error message will appear on the bottom of the screen if any problem occurs. Wait for the Haematology Analyser to warm up if 'Low Temperature' warning occurs.

Enter Patient Details as follows:

- > **Animal**, to select species
- > **Info**, and enter details (Make sure you enter a number to identify the blood sample)
- > **Confirm**

IMPORTANT Gently mix EDTA blood sample before holding the open tube under sampling probe

- > **Start**, (press large black touch sensor pad behind sampling probe)

Analysis will commence automatically.

Take photo of results on screen to reduce use of printer paper, or - > **Print**

- > **Animal**, to begin another sample, or proceed to **Shutdown** as instructed below

IMPORTANT

Always perform **Shutdown** before turning off the power

- > **Function** - > **Shutdown**

Hold container with concentrated cleaner under sampling probe

- > **Start**

Analyser will automatically perform cleaning cycle. Wait until this is finished.

- > Switch **power off** at rear of analyser when prompted.

Video demonstration: <https://youtu.be/2bn7HqTWbiE>

Haematology - Interpretation of Analyser results

Leucogram

WBC : White blood cell count is the number of white blood cells (**Leucocytes**) per volume of blood

There are five types of white blood cells, each with different functions:

neutrophils, lymphocytes, monocytes, eosinophils and basophils

LYM : lymphocyte count

Lymphocytes occur in two forms: B cells which produce antibodies, and T cells which recognize foreign substances and process them for removal. They are long-lived, relatively small cells and can be the dominant WBC type in ruminants.

MID : Mid-size cell count

This includes monocytes, eosinophils and basophils (and sometimes abnormal cells)

Monocytes are function in the ingestion of bacteria and other foreign particles.
Eosinophils function in allergic and parasitic responses and in resisting some infections.
Basophils may increase or decrease in certain diseases.

GRAN : Granulocyte count.

Neutrophils (also known as segs, PMNs, granulocytes, grans).
Normally the most abundant type of white blood cell in healthy dogs, cats and horses. Relatively large and short-lived cells.

Gran %

Granulocytes. Normally up to 50% of total WBC count in cattle. (50-70% in dog)

Mid %

Basophils. Normally constitute 1% or less
Eosinophils. Normally about 1- 3%
Monocytes make up to 10%

Lym %

Lymphocytes. Normally up to 70% of the total WBC count in cattle. (40% in dog)

Leucocytosis (increased WBCs)

Physiological : due to adrenaline release (fight or flight response)

neutrophilia and lymphocytosis

Stress : due to exogenous corticosteroid release

neutrophilia with lymphopenia and eosinopenia (and sometimes monocytosis in dogs)

Inflammatory : due to inflammatory cytokines (interleukins)

immature neutrophils (or left shift) [Note: VTH analyser does not measure this]

neutrophils can show signs of toxic change [VTH analyser does not measure this]

can occur with or without leucocytosis

lymphopenia and eosinopenia may occur (but this could also be caused by stress)

Leucopenia (decreased WBCs)

acute viral infections due to disrupted WBC production

severe inflammation mild leucopenia due to neutropenia with a shift to the left

stress mild leucopenia due to lymphopenia

chronic conditions sepsis, autoimmune disease, rickettsia, tuberculosis, psittacosis, Lyme Disease, dengue, malaria, certain cancers, and some mineral deficiencies

immunosuppressive drugs including corticosteroids

Erythrogram

RBC : Red blood cell count (erythrocytes)

HGB : the amount of Haemoglobin in the blood. Lipaemia falsely increases HGB.

HCT : the Haematocrit is the percentage of red blood cells (similar to PCV)

MCV : mean cell volume

elevated when RBCs are larger than normal (macrocytic).
decreased when RBCs are smaller than normal (microcytic).

MCH : Mean Corpuscular Haemoglobin is the amount of haemoglobin inside the average red blood cell.

Not a very useful parameter since low MCH can be due to small RBCs with normal haemoglobin, or normal sized RBCs with low haemoglobin.)

Macrocytic RBCs are large so tend to have a higher MCH, while microcytic red cells would have a lower value.

MCHC : Mean Corpuscular Haemoglobin Concentration is the average concentration of haemoglobin inside a single red cell.

About 33% of RBCs consist of haemoglobin. So, HGB is usually 1/3rd of HCT. ie MCHC = 33%

(The values are higher in camelids due to higher normal haemoglobin levels)

Low MCHC = Hypochromic High MCHC = Hyperchromic

RDW : Red cell Distribution Width is an index of the variation in the size of the RBCs

A high RDW indicates that the RBCs are more variable in size than normal.

Examples: regenerative anaemia due to more large immature RBCs
 iron anaemia causing more smaller RBCs

Platelet : The platelet count is the number of platelets (thrombocytes) in a given volume of blood.

Both increases and decreases can point to abnormal conditions of excess bleeding or clotting.
Artifact decrease occurs if there is platelet clumping.

Erroneous Haematology Analyser results can be caused by:

- clots in the sample
- fragmented cells (do not shake the sample tube)
- lipaemia
- fibrin
- aggregated platelets

If in doubt, prepare a blood smear for examination.

WBC Histogram

Normal : 3 peaks and 2 troughs

Lymphocytes -> Mid-sized cells -> Granulocytes

Curve shape indicates size (x axis) and number (y axis) of cells in that section of the histogram

Relative numbers of lymphocytes and granulocytes can be observed in the histogram, but monocytes, eosinophils and basophils can only be identified as a group (not separately)

Grossly abnormal histograms usually require microscopic examination of slide preparations for clarification

RBC Histogram

Normal : Gaussian bell curve

Wide base : increased RDW (more mixed cell size)

Moved to Left : microcytic (small RBCs). Low MCV (chronic anaemia)

Moved to Right : macrocytic (large RBCs). High MCV

More than one peak : more than one distinct population of cells

Platelet Histogram

Normal usually asymmetrical, since there are normally more small vs large cells

Increased MPV (Mean Platelet Value)

suggests an increased number of immature platelets (regenerative thrombocytopenia)

Increased MPV artifact

due to platelet clumping

or, prolonged storage

Note Cats normally have more large platelets than other species

References

Video demonstration: <https://youtu.be/2bn7HgTWbiE>

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- <http://www.d91.k12.id.us/documents/healthscreenresults.pdf>
Human haematology cells and range
- <http://veterinarycalendar.dvm360.com/interpreting-blood-work-small-ruminants-proceedings?id=&pageID=1&sk=&date=>
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- <https://journals.sagepub.com/doi/full/10.1177/1040638714546490> Normal cattle ranges
- <https://link.springer.com/article/10.1007%2Fs00580-003-0490-2> Buffalo haematology
- <http://infovets.com/books/smrm/D/D125.htm> see Sheep/Goat table below

Test	Sheep	Goats	Units
Packed Cell Volume (PCV)	27 - 45	22 - 38	%
Red Blood Cell (RBC)	9 - 15	8 - 18	x 10 ⁶ /uL
Reticulocytes	<0.5%	0	#/uL
Platelets	240 - 700	340 - 600	x 10 ³ /uL
Segmented Neutrophils	0.7 - 6.0	1.2 - 7.2	x 10 ³ /uL
Band Cells	Rare	Rare	x 10 ³ /uL
Lymphocytes	2 - 10	2 - 9	x 10 ³ /uL
Eosinophils	0 - 1	0.05 - 0.065	x 10 ³ /uL

Haematology - Normal reference range from pooled sources

PARAMETER	UNITS	CATTLE	BUFFALO	GOAT	SHEEP	POULTRY	DOG	CAT
WBC	10 ³ /uL	4 - 16.	9 - 14.	4 - 13.	4 - 12.	3 - 5.	6 - 17.	5 - 16.
LYMPHOCYTES # %	10 ³ /uL %	1 - 9 20 - 68%	33 - 46%	2 - 9 5 - 30%	2 - 10 8 - 30%		1 - 4 8 - 20%	2 - 7 25 - 35%
MID-SIZED # %	10 ³ /uL %	0.1 - 2 0 - 28%	1 - 9%	0 - 0.7 1 - 8%	0 - 1 0 - 10%		0.1 - 1 0 - 9%	0 - 1.5 0 - 10%
GRANULOCYTE # %	10 ³ /uL %	1 - 5 15 - 65%	48 - 65%	1 - 7 30 - 48%	1 - 6 20 - 40%		4 - 8 55 - 85%	3 - 13 45 - 65%
RBC	10 ⁶ /uL	5 - 10.	6 - 10.	8 - 18.	9 - 15.	4 - 5.	5 - 8.	6 - 10.
HGB	g/L	85 - 130	110 - 130	80 - 120	80 - 160	110 - 140	130 - 190	110 - 150
HCT	%	24 - 46%	36 - 46%	22 - 38%	24 - 45%	25 - 45%	37 - 54%	33 - 50%
MCV	fL	38 - 56	46 - 60	16 - 20	23 - 48	80 - 90	66 - 75	40 - 50
MCH	pg	13 - 20	12 - 20.		8 - 12.	26 - 29	22 - 27	12 - 16.
MCHC	g/L	320 - 400	250 - 350		310 - 380	310 - 340	340 - 360	300 - 330
PLT	10 ³ /uL	120 - 820		300 - 600	100 - 800		150 - 430	250 - 600