

# Evaluation of the red blood cells (Erythrocyte picture)

By

**Prof. Mahmoud Rushdi**  
**Faculty of Veterinary Medicine**  
**Assiut University**  
**Egypt**

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## Complete Blood Count:

	Patient Value	Normal Range 2 years – 6 years
WBC	8.4 x 10 <sup>9</sup> /L	( 5.0 – 17.0 )
RBC	2.77 x 10 <sup>12</sup> /L	( 3.90 – 5.30 )
Hgb	7.5 g/dl	( 11.5 – 13.5 )
Hct	21.8 %	( 34.0 – 40.0 )
MCV	78.6 fl	( 75.0 – 87.0 )
MCH	26.9 pg	( 25.0 – 31.0 )
MCHC	34.2 gm/dl	( 31.0 – 36.0 )
RDW	17.3 %	( 11.5 – 15.0 )
PLT	192 x 10 <sup>9</sup> /L	( 150 – 450 )

## Differential:

	Absolute	Normal Range Number      2 years – 6 years	
Neutrophils	43 %	(3.61)	( 1.50 – 8.50 )
Bands	6 %	(0.50)	( 0.00 – 1.00 )
Lymphocytes	41 %	(3.44)	( 3.00 – 9.50 )
Monocytes	4 %	(0.34)	( 0.00 – 0.80 )
Eosinophils	3 %	(0.25)	( 0.02 – 0.65 )
Metamyelocytes	3 %	(0.25)	N/A
NRBC / 100 WBC	1		

**Evaluation of the red blood cells (RBCs)  
Erythrocytes picture**

Determination of RBCs count (/mm<sup>3</sup> or T/l)

Determination of Hemoglobin concentration (g/dl)

Determination of Packed cell volume (%)

Determination of erythrocytes morphology

Determination of Mean corpuscular values (MCV, MCH, MCHC)

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**TOTAL ERYTHROCYTES COUNTS**

Manual

Hemocytometer

Automatic

Blood Cells Counter

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## **Physiological Factors affecting the RBCs count:**

### **- Life span of the erythrocytes**

The life span of the erythrocytes varies according to the animal species (in cattle 150 days, in equine 145 days, in feline 70 days).

### **- Exercise**

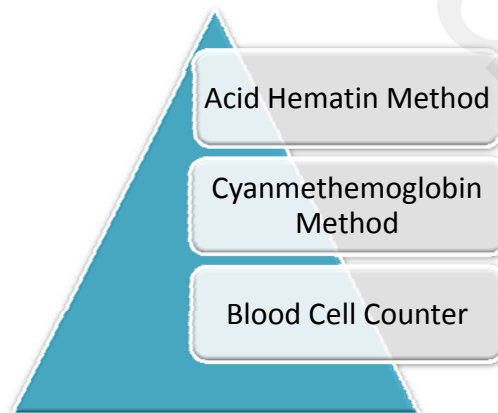
### **- High altitude**

### **- Emotional condition, fear or excitement**

### **- Age, sex and pregnancy**

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## **HEMOGLOBIN CONCENTRATIONS**



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## **Hemoglobin concentration**

### **Increase haemoglobin concentration**

- ❖ Chronic carbon monoxide poisoning.
- ❖ Polycythemia.
- ❖ Cardiac diseases.
- ❖ Pulmonary diseases.

### **Decrease hemoglobin concentration**

- ❖ Anemia.
- ❖ Amyloid nephrosis.
- ❖ Leukaemia.
- ❖ Malignant tumors.

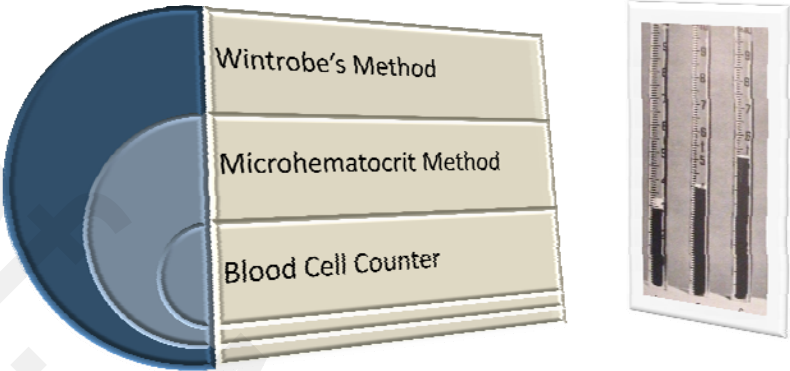
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## **HEMATOCRIT PACKED CELL VOLUME (PCV)**

**Packed cell volume (PCV) or Hematocrit, is defined as the percent of blood occupied by RBCs, or simply you can define PCV as the percent of RBCS in whole blood.**

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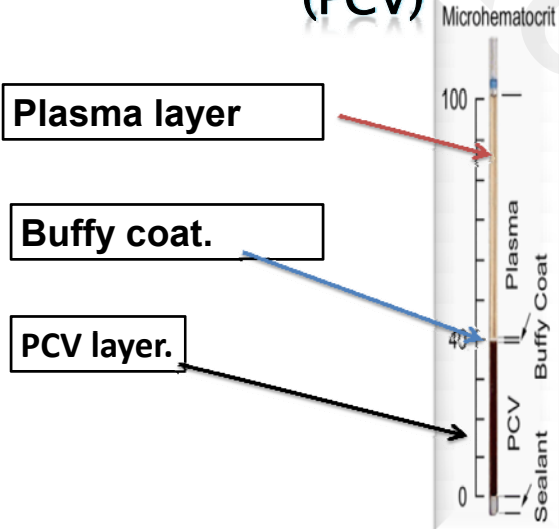
### PACKED CELL VOLUME (PCV)



The diagram illustrates three methods for measuring Packed Cell Volume (PCV): Wintrobe's Method, Microhematocrit Method, and Blood Cell Counter. To the right, a microhematocrit tube is shown with a scale from 0 to 100.

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### HEMATOCRIT PACKED CELL VOLUME (PCV)



The diagram shows a microhematocrit tube with a scale from 0 to 100. The tube is divided into three distinct layers: a top plasma layer (indicated by a red arrow), a thin buffy coat (indicated by a blue arrow), and a bottom PCV layer (indicated by a black arrow). The PCV layer is approximately 40% of the total volume. Labels include Plasma, Buffy Coat, PCV, and Sealant.

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### **Advantages of the microhematocrit method:**

- The amount of blood required is considerably less.
- Time required for the entire procedure is less.
- accurate.

### **Disadvantages of the microhematocrit method**

- Special reader is required for reading.
- It is impossible to determine E.S.R. in such small tubes.
- It is difficult to evaluate the depth of the buffy coat.

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### **Interpretation of packed cells volume**

#### **a. PCV layer**

**An elevated PCV layer occurs in cases of:**

- 1- Physiological.**
- 2- Hemoconcentration following dehydration.**
- 3- Chronic obstructive pulmonary disease.**
- 4- Pulmonary diseases that associated with hypoxia.**
- 5- Congestive heart failure.**
- 6- Polycythemia**

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**Lowered PCV layer occurs in cases of:**

- Anemia.
- Hemodilution
- Renal failure, as a result of decreased secretion of erythropoietin.
- Malignant tumors
- Leukemia

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## **2. BUFFY COAT**

In blood from normal animal, the buffy coat consists of a white to gray layer 0.5 to 1.2 mm. In size occurring immediately above the PCV layer.

For routine clinical application, a buffy coat of less than 0.5 mm would suggest leucopenia, while above 1.5 mm indicate Leucocytosis

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### 3. PLASMA LAYER

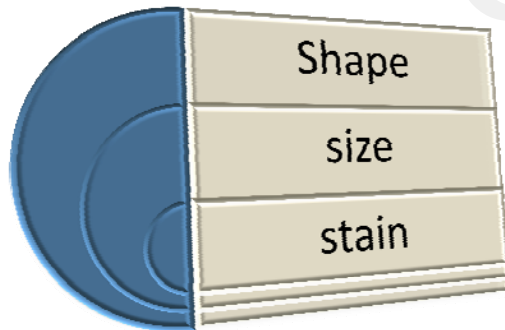
The color of the plasma can help with :

- a) Dark yellow color is an indicator for hemolytic, hepatic and obstructive jaundice.
- b) The pink color of plasma is indicative for hemolysis of erythrocytes, which associate some diseases as bacillary hemoglobinuria and blood parasites as Babesia species .
- c) Milky color of plasma indicates the increase of lipids in blood.

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#### DETERMINATION OF ERYTHROCYTES MORPHOLOGY



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## **Morphological examination of erythrocytes**

All parameters of the erythrocyte picture can be determined using a blood cell counter, except assessing the morphology of the RBCs, which must be evaluated using a blood smear. This means, that both electronic blood cell count and blood smear are required to perform the erythrocyte picture.

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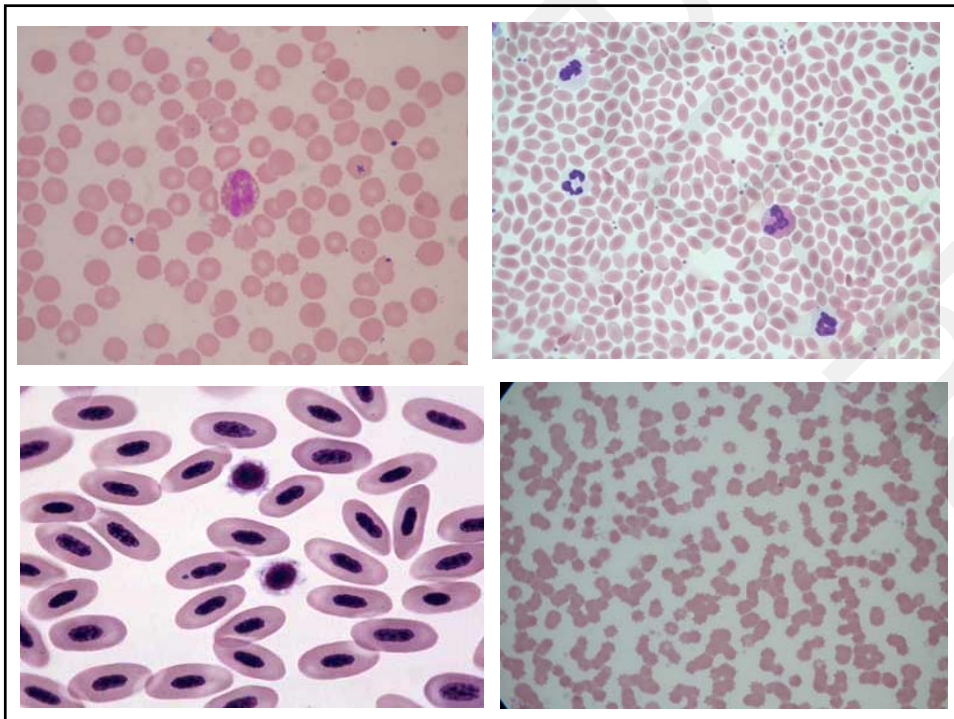
## **Morphological examination of erythrocytes**

**Morphological examination of erythrocytes is carried out by:**

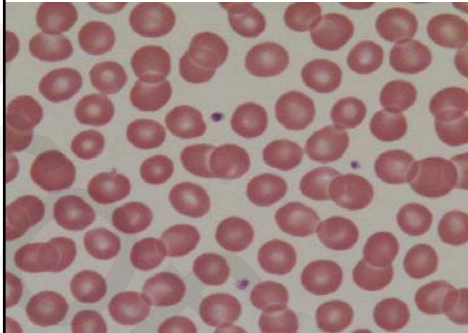
- Examination of a stained blood film (Giemsa stain) under the light microscope and by using the oil immersion lens (X100), the RBCs are examined for shape, size, and stain.
- Calculating and interpreting the mean corpuscular values (indices).

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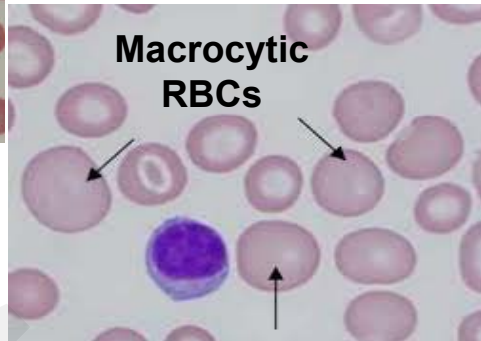
## Evaluating the shape of the RBCs



## Evaluation of the Size of the RBCs

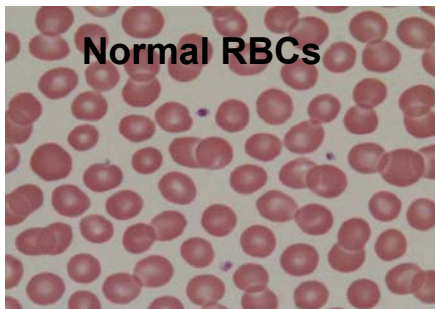


Normal RBCs

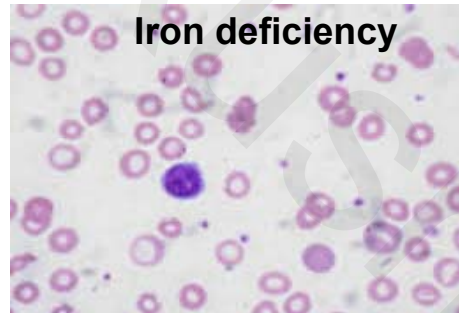


Macrocytic RBCs

## Evaluation of the stain of the RBCs



Normal RBCs



Iron deficiency



Polychromasia

<b>MEAN CORPUSCULAR VALUES</b>
<p><b>1. MEAN CORPUSCULAR VOLUME (MCV)</b></p> $\text{MCV (fl)} = \frac{\text{PCV \%} \times 10}{\text{RBC count } /\mu\text{l}}$
<p><b>2. MEAN CORPUSCULAR HEMOGLOBIN (MCH)</b></p> $\text{MCH (pg)} = \frac{\text{Hb. g/dl} \times 10}{\text{RBC count } /\mu\text{l}}$
<p><b>3. MEAN CORPUSCULAR HEMOGLOBIN CONCENTRATION (MCHC)</b></p> $\text{MCHC (g/dl)} = \frac{\text{Hb. g/dl} \times 100}{\text{PCV \%}}$

<p><b>1. MEAN CORPUSCULAR VOLUME (MCV)</b></p> <p>Mean corpuscular volume (MCV, fl or femitoliter) is a measure of average size of RBC and represents the volume of a single RBC.</p> <p><b>This value used to classify red cells as:</b></p> <ul style="list-style-type: none"> <li>• Normocytic red blood cells are of normal size.</li> <li>• Microcytic red blood cells are smaller than normal.</li> <li>• Macrocytic red blood cells are larger than normal.</li> </ul> <p style="text-align: center;"><a href="http://www.education.advetresearch.com">www.education.advetresearch.com</a></p>
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## **2. MEAN CORPUSCULAR HEMOGLOBIN (MCH)**

Mean corpuscular hemoglobin (MCH, pg or pictogram) is average weight hemoglobin of erythrocyte in a population of erythrocytes.

## **3. MEAN CORPUSCULAR HEMOGLOBIN CONCENTRATION (MCHC)**

Mean corpuscular hemoglobin concentration (MCHC, g/dl) is the average percent of hemoglobin occupied by the erythrocyte (g/dl)

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**Based on MCH and MCHC red blood cells may be:**

- Normochromic red cells with normal Hb concentration.
- Hypochromic red cells with lowered Hb concentration.
- Hyperchromic red cells with elevated Hb concentration.

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