

4. Packed Cell Volume (PCV) or Haematocrit

The packed cell volume (PCV) is expressed as a percent volume of packed cells in whole blood after centrifugation. The term PCV is preferred over haematocrit to expressed packed cell volume since haematocrit means a centrifuge. PCV is obtained by centrifuging blood sample containing suitable anticoagulant in graduated Wintrobe haematocrit tube using haematocrit centrifuge at 3000 rpm for 30 minutes (a layer of packed leucocytes is formed just above the packed erythrocytes). Usage of micro-haematocrit technique where the heparinized blood samples are centrifuged at high speed for 3 to 5 minutes facilitates the determination of large number of samples in a short time, requiring very small amount of blood (one drop). PCV values in most domestic animals varies between 38 and 45% with an average value of 40, but in Buffaloes it is 22-41%.

Erythrocyte Sedimentation Rate (ESR)

When the blood after the addition of a suitable anticoagulant is allowed to stand, the erythrocytes progressively settles at a certain rate to the bottom leaving clear plasma above, which is known as erythrocyte sedimentation rate. It is usually measured within one hour of collection of blood in standard tubes placed in vertical position by the distance in millimetres through which the upper most layer of erythrocytes pass in a given time. The precise mechanisms and reasons due to which ESR vary within and among species are not known. Plasma proteins (fibrinogen and/or globulin) may influence the degree of coagulation of erythrocytes which may be an important factor influencing ESR. The viscosity of plasma, specific gravity of the corpuscles or plasma or the size of erythrocytes had nothing to do with sedimentation rate.

Erythrocyte sedimentation rate helps to evaluate the health status of the animal. It is increased due to anemias, acute general infections, malignant tumours, inflammatory conditions, hypothyroidism, pregnancy etc. The sedimentation rate is high in horses whereas the erythrocytes of ruminants settle very slowly.

Table 8 : Erythrocyte sedimentation rate of domestic animals.

Species	mm / hr
Cattle	0.34
Horses	45-114
Pig	1-14
Dog	6-10
Chicken	1.5
Human male	0-6.5
female	0-12

Blood Reaction

Blood reaction usually refers to the pH of the blood plasma in intact animal. The pH range of 7-7.8 is compatible with life and under normal circumstances it fluctuates within these narrow limits. Arterial blood is more alkaline than venous blood. The plasma is more alkaline than corpuscles. Though large amounts of acids (carbonic, lactic, pyruvic, phosphoric, sulphuric, uric etc) and alkalies are produced as a result of body metabolism, the pH of the blood is maintained within the limits by buffer systems and by eliminating CO₂, ammonia and hydrogen ions through respiratory and renal mechanisms.

The alkali reserve is carbon dioxide combining capacity of blood. Around 95% of CO₂ unites with the bicarbonate in plasma and the remaining portion with plasma proteins and in physical solution. To maintain the acid base balance in turn the alkali reserve of the body, animal should ingest adequate quantities of electrolytes.

Anemias

Anaemia means a deficiency of red blood cells, which can be caused by either too rapid loss of blood or by too slow production of red blood cells. Anemias may be classified according to number and size of cells and the haemoglobin content.

1. *Normocytic and normochromic anaemia* : In such anaemia, there is a decrease in number of cells but the cells retain their normal size and haemoglobin content. Such anaemia is a result of acute haemorrhage because plasma volume is replenished long before the RBCs are restored.
2. *Microcytic and hypochromic anaemia* : In such anaemia the decrease in number of cells is accompanied by a decrease in cell size and

haemoglobin content. This anaemia is caused by a deficiency of iron in the diet.

3. *Macrocytic and hyperchromic* : In such anaemia the decrease in number of cells is accompanied by an increase in cell size and haemoglobin content. Such a condition is characteristic of pernicious anaemia caused by lack of extrinsic factors (Vitamin B12) or intrinsic factor produced in gastric mucosa.
4. *Aplastic anaemia* : It is caused by malfunctioning of bone marrow; may result from excessive X radiation or from unknown cause.
5. *Sickle cell anaemia* : Cells are abnormal in shape (sickle shaped) and normal oxygen transport function is disrupted. This condition is hereditary in nature.

Anaemias cause decreased efficiency of the transport of oxygen to the tissues because of decreased haemoglobin. Anaemic animals fatigue rapidly and their endurance is weakened. Polycythemia is a disorder characterised by increased erythrocytes and it may be caused by dehydration by an overactive bone marrow. Hypoxia or high altitude, markedly increase the RBC number : however after a normal animals adapts to high altitude, the number decreases and may approach those observed at sea levels.

Causes of Anaemia

1. Blood loss
2. Bone marrow aplasia (aplasia means lack of development of an organ or tissue or of the cellular products from an organ or tissue).
3. Deficiency of vitamin B₁₂ or folic acid.
4. Haemolyses of red cells.
5. Deficiency of iron in the diet.

Lymph

Composition, Formation and Flow

The intracellular fluid diffuses and is filtered into blind ended ducts where it is called lymph. Lymph has the same concentration of salts as interstitial fluid and plasma, a lower concentration of proteins than plasma and a slightly higher concentration of proteins than interstitial fluid.

The distal lymphatics form a closed system of tubes, consisting of an endothelial lining supported by fibrous tissue. The larger vessels have muscle fibres in their walls. The lymphatic vessels possess numerous valves and the flow of lymph from the periphery to the thoracic duct is brought about by muscular and respiratory movements in the same way as the flow of blood in the veins. The lacteals of the intestine show rhythmic contractions ranging from 1 per min, which because of the numerous valves in these vessels, propel the lymph on to the thoracic duct.

In the sheep the lymph flow pressure may be as high as 25 mg Hg.

Oedema : Complete obstruction of the lymphatic vessels draining a part of the body leads to oedema of the area.

Blood Coagulation

Blood, when it leaves the blood vessels (such as after a cut) and comes in contact with external objects or air, sets into a kind of jelly or clot. Such a process is useful in lessening the loss of blood when blood vessels are injured. But so long the blood is in undamaged blood vessels it remains fluid almost indefinitely. This happens in the blood of all vertebrates which includes all domestic animals including dog, cat, buffalo, sheep, goat, camel and cattle.

This clotting process is mediated by several blood clotting factors and calcium ions. Vitamin K, a fat soluble vitamin found in cabbage and spinach is also necessary for this process. Coumarol poisoning in cattle fed with hay made from sweet clover delays or prevents the blood clotting system of such animals.

Blood present in vessels of body do not coagulate because of the presence of heparin, an anticoagulant produced from the liver.

Clot Retraction : When blood clot is allowed to stand for some time, the clot retracts to a smaller volume and presses out a clear fluid, the blood serum which will not clot any more.

The coagulation takes place most rapidly at body temperature and is generally slowed by cold. Thus if horse blood which always clots slowly is cooled to between 0°C and 1°C, it will remain fluid for an indefinite time. Similarly serum formation during summer is more quick as compared to winter, a common problem encountered by