



# Blood values to assess pet's health

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A wide variety of tests are used to certify good health or indicate the presence of infection or disease. Pet practitioners and pet owners should always be aware of the normal baseline values of some important parameters that should be monitored closely when the animals become ill. Moreover they are the best diagnostic tools available to them.

## I. Complete Blood Count (CBC) Values

1. Red Blood Cells (RBC): Responsible for carrying oxygen and carbon dioxide throughout the body. Iron deficiency will lower RBC count. In more reduced count, it may indicate hemorrhage, parasites, bone marrow disease, B-12 deficiency, folic acid deficiency or copper deficiency. The normal for dogs is  $5.6-8.7 \times 10^6$  RBC's per microlitre and  $6.1-11.9 \times 10^6$  / microlitre for cats.

2. Hematocrit or Packed Cell Volume (PCV): Provides information on the amount of red blood cells present in the blood. Decreased levels means anemia from hemorrhage, parasites, nutritional deficiencies or chronic disease process, such as liver disease, cancer, etc. . Increased levels are often seen in dehydration. The normal for dogs is 40-55 % and is 29-50 % for cats.

3. Hemoglobin (Hb): The essential oxygen carrier of the blood. Decreased levels indicate the presence of hemorrhage, anemia, iron deficiency. Increased levels indicate higher than normal concentrate of RBC. The normal hemoglobin level for a dog is 14-20 grams/decilitre and 9-15.6 g/decilitre for cats.

4. Reticulocytes: They are the immature red blood cells. Decreased count is usually associated with anemia. Increased count is associated with chronic hemorrhage or hemolytic anemia. In the non-regenerative anemia, there are no or very few immature RBC's in the sample and the body continues to lose red blood cells but no new ones are produced. The normal reticulocytes count in dogs is 0 to 1.5 % and in cats is 0-1 % of the total RBC.

5. Platelets (PLT): Play an important role in blood clotting. Decrease in number occurs in bone marrow depression, auto immune hemolytic anemia, systemic lupus, severe hemorrhage or intravascular coagulation. Increased number may occurs with fracture or blood vessel injury, or cancer. The normal range for dogs is 2-9 lakhs / microlitre and for cats is 3-7 lakhs / microlitre of blood.

6. MCV: Measurement of the average size of the RBC. Elevated volumes can be due to B-12 folic acid deficiency and reduced volumes are from an iron deficiency. In dogs, the normal MCV averages between 60-77 femtolitre and in cats it is 39-55 femtolitre.

7. White blood cells (WBC): The body's primary means of fighting infection. Decreased levels may indicate an overwhelming infections (viruses), or drug / chemical poisoning. Increased levels indicate bacterial infection, emotional upsets and blood disorders. For every leukocyte present in a sample there will normally be 600 to 700 RBC's. The normal range for a WBC count in the dog is between 6,000 and 17,000 per microlitre and in the cat 4,900-20,000/microlitre. There are several types of white blood cells in the circulation.

a. Neutrophils: When first released from the marrow neutrophils are bands and after spending some time in the circulating blood they mature into

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segmented (segs). The normal range in dogs for mature neutrophils is between 3,000 to 12,000/microlitre. The normal for the bands is approximately 100 to 300 per microliter. The normal range in cats for segs is between 2,500 and 12,500 per microliter. When total neutrophil numbers are increased it is usually a sign of a bacterial infection or some form of extreme stress. If the number of bands increases dramatically in relation to the number of segs it is thought to be a more severe reaction since the body is releasing more and more immature cells into the circulation to defend itself against the infection. In most viral infections, the total number of neutrophils decreases.

b. Eosinophils: Eosinophils are normally seen in fewer numbers than neutrophils. They are also produced in the bone marrow and have the ability to eat up or engulf foreign particles into their bodies. Their quantities increase in the circulating blood when the animal is suffering from an infection with parasites, or has allergies. The normal range in dogs is 100 - 1250 / microliter of blood and that of cats is 0-1500 / microliter of blood.

sc. Basophils: These are the least common of all the WBC's. In many samples, none are present. Their function is unknown but they are also produced within the bone marrow.

d. Lymphocytes: They are formed and released from lymphoid tissue such as lymph nodes, spleen, etc.. When lymphocytes numbers decrease it is referred to as a lymphopenia and is frequently noted in the initial stages of infections (example: parvovirus infection ) or following the use of corticosteroids like prednisone and chemotherapy drug. When bacterial or viral infections have gone on for a long time or in certain autoimmune diseases, lymphocytes' number increases. A common cause of increased lymphocytes is leukemia which is a cancer of blood cell production that is usually fatal. There are normally 500-4,800 of these in a microliter of dog's blood and 1,500-7,000/microliter in a cat's.

e. Monocytes: Monocytes are developed and are stored in the spleen and bone marrow. Normally there are only 100 to 1800 of these per microliter of dog's blood, and 0-850/microliter in a cat. Their numbers do not vary greatly unless there is a cancerous leukemia condition affecting their cell lines.

## II. Blood chemistry panel

Measures the quantities of various electrolytes, enzymes, or chemical compounds in the liquid portion of the sample.

A. Blood Glucose: Blood glucose is a measure of the animal's nutritional level but it is more often used to monitor metabolism and physiology. The normal range in dogs for blood sugar is 60 to 120 mg/deciliter and is 70 to 120 mg/deciliter in cats. If the results are lower than 60 the animal is said to have low blood sugar and is referred as hypoglycemic. If the findings are much greater than 130, the dog is said to be suffering from hyperglycemia. Hypoglycemia is a frequent problem in young puppies, especially the toy and smaller breeds. These animals may seem weak, uncoordinated, and even have seizures. Some adult dogs also have problems with hypoglycemia, especially during periods of increased or prolonged activity which is very common in some of the hunting breeds. Slightly elevated blood sugar results are often found when the animal is stressed or very excited when the blood sample is taken.

B. BUN (Blood Urea Nitrogen): The proteins that animals consume in their diet are large molecules. As they are broken down and utilized by the body, the by-product of this metabolism is nitrogen-containing urea compounds formed in the liver. These are of no use to the body and are excreted by the kidney. If the kidney is not working correctly and filtering these compounds from the blood (kidney failure), they build up to excessively high levels. When this happens to a human they are said to be "uremic" and will probably be placed on a dialysis machine. Decreased levels of BUN are seen with low protein diets, liver insufficiency, and the use of anabolic steroid drug. Elevated levels can indicate kidney disease, but can also be caused by dehydration or urinary tract obstruction. The normal value for dogs is 6-24 mg/deciliter and for cats is 17-30 mg/deciliter.

C. Creatinine: Creatinine is a by-product of muscle metabolism and is excreted by the kidneys. Creatinine is also used to measure the filtration rate of the kidney. Only the kidneys excrete this substance and if it builds up to higher than normal levels, it is a sign of decreased or impaired function of these organs. Elevated levels





can indicate kidney failure or urinary obstruction, muscle disease, arthritis, hyperthyroidism, and diabetes. An increased BUN and normal creatinine suggest an early or mild problem. An increased creatinine and increased BUN with elevated phosphorus indicate a long standing kidney disease. The normal range in dogs is 0.4-1.4 mg / decilitre and in cats is 0.6-1.6 mg / decilitre.

D. Calcium: Blood calcium levels are influenced by diet, hormone levels and blood protein levels. Decreased levels indicate acute damage to the pancreas or underactive parathyroid. Muscle twitches may occur in decreased level. Increased levels can be an indicator of certain types of tumors, parathyroid or kidney disease. While a dog is pregnant or nursing puppies, the calcium level can become seriously depressed in a disease called eclampsia. The normal value in dogs is 9.5- 12 mg / decilitre and in cats is 9.4 -11.2 mg / decilitre.

E. Total Serum Protein ( TSP ): Increased level indicates dehydration or blood cancer, bone marrow cancer; decreased level indicates malnutrition, poor digestion, liver or kidney disease, bleeding or burns. The total protein content in dogs is 5.2-7.2 g/decilitre and in cats is 5.3-7.2 g/decilitre.

F. The total serum protein level is a combined measurement of two blood protein molecules, albumin and globulin.

i. Albumin: Albumin is a common blood protein produced by the liver. Albumin levels are depressed when the animal is receiving inadequate or poor quality nutrition or following chronic infectious diseases in which their stores have been used up and not yet replaced. Reduced levels of this protein can point to chronic liver or kidney disease or parasitic infections such as hookworm. High levels indicate dehydration. The normal values in dogs is 2.5-4.3 g/decilitre and in cats is 2.6-3.9 g/decilitre.

ii. Globulins: The term "globulins" includes immunoglobulins which are produced by the body's immune system as part of the body's defense against bacteria and viruses. In certain diseases, such as Feline Infectious Peritonitis, elevated globulins can occur. Decreased levels indicate problems with antibodies, immunodeficiency viruses or risk of infectious disease.

Increased levels may indicate stress, dehydration or blood cancer, allergies, liver disease, heart disease, arthritis, diabetes, etc... The normal level in dogs is 0.9-4 g/decilitre and in cats is 1.5-4.0 g/decilitre.

G. Bilirubin: Bilirubin is a pigment by-product formed of the breakdown of hemoglobin. Bilirubin levels may be higher than normal when excessive numbers of red blood cells are breaking down or if the liver is diseased and unable to clear the bilirubin from the blood. If there is an obstruction within the liver or bile duct thereby the bilirubin cannot be released into the intestine, blood levels will also elevate. Elevated bilirubin levels produce a yellowing of the skin and mucous membranes that is termed jaundice or icterus. This is usually seen in dogs with certain anemias or liver/gallbladder disease.

The normal range in dogs is 0.04-0.4 mg / decilitre and in cats is 0.08-0.3 mg / decilitre.

H. Alkaline Phosphatase (ALP): An enzyme produced by the biliary tract (liver), bone, intestines and kidneys. High levels indicate bone disease, liver disease or bile flow blockage. In addition, drugs such as corticosteroids and phenobarbital can cause increased ALP levels. Very high ALP levels can be seen in dogs with adrenal gland disease as well. The normal value in dogs is 20-200 U / L and in cats is 20-220 U/L.

I. SGPT: Serum Glutamic Pyruvic Transaminase (SGPT) is also called "alanine amino transferase (ALT). It is an enzyme important in liver function. The liver may be cancerous, have an infection within it, be congested or engorged with too much blood (as in heart failure), worn out as in cirrhosis, obstructed so that the waste products and toxins it filters from the blood cannot be removed from the body via the bile duct, etc..., leads to injury of liver cells and this enzyme is released into the blood stream. Basically, anything that adversely affects the liver or its ability to function correctly will elevate the SGPT. The normal values in dogs and cats are 10-70 U/L and 10-130 U /L.

J. Cholesterol: Hardening and obstruction of the vessels of the heart is not a common problem in canine and feline medicine. Animals with inadequately functioning thyroid glands often have elevated cholesterol. Starving animals or those with poor levels of nourishment may have lower than expected cholesterol. Elevated cholesterol levels are often seen

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