

# Understanding a Basic Blood Chemistry Report

## Chemistry Analysis

**Glucose** is sugar used by the cells to provide energy and is the only fuel that can be used by the brain and nervous system (other tissues can burn fats for energy). Glucose comes from digesting carbohydrates and may be stored for later use. It is primarily kept in balance by 2 pancreas hormones – insulin and glucagon, although the liver, adrenal and thyroid glands are also involved. Hemoglobin A1c evaluates the average amount of glucose in the blood over the last two or three months. Increased glucose or Hemoglobin A1c values relate to diabetes, stress, metabolic disorders and diet. Decreased values can reflect hypoglycemia, insulin overproduction, alcoholism and liver disorders.

**Uric Acid** is an end product protein digestion mainly a type of protein called purine. This protein can come from certain foods and from breaking down purine proteins in the nucleus of cells. Increases occur with improper kidney elimination or with gouty arthritis, alcoholism and high protein diets. Decreases are primarily associated with low protein diets or malabsorption.

**BUN (Blood Urea Nitrogen)** is an end product of protein breakdown. It's produced mainly in the liver and is eliminated by the kidneys. Increases can be caused by excessive protein, dehydration and kidney disorders. Decreases are related to poor diet, liver problems, excessive water and malabsorption.

**eGFR (estimated Glomerular filtration rate)** is a measure of kidney function by taking the level of blood creatinine and using a formula to see how well the tiny filters of the kidneys are functioning to remove waste products from the blood while preventing loss of important blood constituents.

**Creatinine** is a waste product of muscle activity and levels are related to muscle mass, how much exercise and strenuous activity performed. Increases can be related to inadequate kidney function. Decreases may be due to lack of muscle mass or degeneration.

**Sodium** is an electrolyte related to fluid balance, the kidneys, the heart and nerve conduction. Sodium is present mainly in fluids surrounding the cells. Increases are seen in hypertension, fluid retention, excessive sodium intake, dehydration and kidney and heart disorders. Decreases are seen with diuretics, excessive sweating, excessive water intake and diarrhea.

**Potassium** is an electrolyte related to fluid balance and is mainly inside the body's cells. It is necessary for proper function of the heart and muscles. Increases are seen with excessive destruction of cells, underactive adrenal glands and kidney disease. Decreases are seen in diarrhea, diuretic use, nutritional deficiency and overactive adrenal glands.

**Chloride** is another electrolyte involved in maintaining proper fluid balance and pH balance. It is also part of the stomach's hydrochloric acid that digests protein and levels are also influenced by kidney function. Increases are seen with an acidic system, in dehydration, and with swelling caused by too much fluid inside the cells. Decreases are seen in excessive sweating, stomach acid deficiency and edema.

**Carbon Dioxide (CO<sub>2</sub>)** is actually the total of bicarbonate and carbon dioxide. These two substances are in equilibrium and help maintain balance of acid and base in the body. The test reflects the ability of the lungs to exchange oxygen for carbon dioxide gas. Increases indicate an

alkaline blood condition and in the extreme, metabolic alkalosis. Decreases show acidity in the blood and in extreme metabolic acidosis.

**Calcium** is a principle component of bones and teeth (99% of the body's calcium is found in these areas). The other 1% is part of blood clotting, nerve and muscle function, and enzyme activities. Increases are seen in parathyroid and thyroid disorders, excess intake of vitamin D, and in acidic conditions of the body. Decreases are seen in parathyroid dysfunction, vitamin D deficiency and magnesium deficiency.

**Phosphorus** is the other principle component of bones and teeth. It helps form compounds for energy production, is related to pH balance, and is necessary for transporting foods for processing from the stomach to elsewhere in the body. Phosphorus and calcium must be in balance for good health. Increases are seen with an alkaline stomach, healing fractures and certain kidney problems. Decreases are found with digestive problems of high stomach acidity and use of aluminum containing antacids.

**Magnesium** is necessary for good function of nerves and muscles. It allows muscles to relax after contraction, calms the nervous system, functions in enzyme systems and is necessary for regulation of heartbeat. It is the second most prevalent mineral inside cells (potassium is first) where it assists with the integrity of DNA and its counterparts. Increases are mainly found in kidney disorders, use of antacids and use of magnesium sulfate enemas. Decreases are seen in cardiac arrhythmia, muscle spasm and cramps, and some viral disorders.

**Total Protein** is a measure of available building blocks used to form enzymes, hormones, antibodies and many structural components like muscle tissue. The main proteins in the blood are albumin and globulin. Increases are seen in liver disorders, alcoholism, chronic infections and inflammation. Decreases are noted in malabsorption, colitis and poor nutrition.

**Albumin** is a primary protein in the blood made from amino acids in the liver and available from the diet, especially from eggs. It helps the immune system, maintains proper fluid balance in tissues and plays a role in nutrient transport and waste removal. Increases are seen in kidney disorders and dehydration. Decreases are noted in decreased immune function and edema.

**Globulin** is the other primary protein that has important functions in immune response and in carrying hormones and lipids. Compounds known as immunoglobulins, (IgA, IgG and IgE) are highly important for immune issues like allergies and infections in the mucus linings of the body. Increases are seen in chronic infection, recovery from acute infections, Rheumatoid arthritis, lupus, and when stomach acids are deficient. Decreases are found in patients with compromised immunity, poor nutrition or malabsorption.

**Bilirubin (Total Bilirubin)** comes from the normal breakdown of red blood cells done by the spleen, which produces indirect bilirubin, and the liver, which produces direct bilirubin. The combination of these two forms is total bilirubin. Increases are seen in liver and spleen dysfunction. Decreases are found in iron deficiency anemia and a type of spleen dysfunction.

**Alkaline Phosphatase** is an enzyme produced primarily in bone, liver and intestines that reflects growth or activity in these areas of the body and is often used as a tumor marker. With its highly alkaline nature, it functions as a pH control in the blood. Increases are seen in some tumors, bone injury, pregnancy, gall bladder obstruction and skeletal growth. Decreases can be in low adrenal function and zinc deficiency.

**LDH (Lactic Dehydrogenase)** is an enzyme formed in all cells of the body and is an indicator of pancreas function with sugar metabolism. Some enzyme types can find which body structure is producing it (heart, lung, liver and skeletal muscle). Increases are seen in heart attack, diabetes, pancreatitis, muscle damage and cancer. Decreases are seen in low blood sugar and poor carbohydrate metabolism.

**SGOT (also called AST)** is an enzyme found mainly in the liver, heart, muscle and gonads. It converts cholesterol to hormones and synthesizes several acids from the breakdown of proteins and fats. Increases are seen in congestive heart disease, heart attack, liver disease and alcoholism. Decreases are seen in gonadal dysfunction and vitamin B-6 deficiency.

**SGPT (also called ALT)** is an enzyme produced primarily in the liver when fatty membranes release stored food substances. It is released when cells die and measures liver and cellular damage. Increases are seen in liver disorders, alcoholism, vitamin A deficiency and heart attack. Decreases are seen in congested liver with poor release of stored nutrients.

**GGT** is an enzyme found mainly in the liver responsible for transporting amino acids and proteins into cells. Increases are seen in bile duct obstruction, liver damage and alcohol use. Decreases are seen in liver congestion and in hypothyroid conditions.

**Iron** is an important part of hemoglobin in red blood cells that carries oxygen to all cells of the body. It also provides information on liver and spleen function. Increases indicate some type of anemia where adequate co-factors are deficient leaving unbound iron that can cause free radicals and damage cells. Decreases are seen in iron deficiency anemia, fatigue and bleeding in the G.I. tract.

**Ferritin** is an iron-containing protein and is the main form of iron stored inside of cells. The small amount of ferritin released into the blood reflects the amount of total iron stored in the body. Increases occur when more iron is absorbed than the body needs. Decreases are seen in iron deficiency, during pregnancy or a condition of chronic blood loss.

**Triglycerides** are circulating fats that are made in the liver and can be a source of energy when glucose cannot be used properly. Increases are seen in diabetes, atherosclerosis, hypothyroid conditions, high fat diet and alcoholism. Decreases are seen in hyperthyroidism, autoimmune disorders, vegetarian diet and deficiency of stomach acid.

**Cholesterol** is derived from diet, formed in the liver and found in all cells. It is used to form hormones, antibodies and bile salts and protects cell membranes. It can be used to evaluate risk for atherosclerosis. HDL cholesterol is the “good” cholesterol and LDL is the “bad” fraction that sticks to the linings of arteries. Increases are seen in atherosclerosis, hypothyroidism, and stomach problems affecting digestion of fats and in high fat diets. Decreases are seen liver disorders, hyperthyroidism and fat restricted diets.

**C-reactive protein (CRP)** is a protein made by the liver and released into the blood within a few hours after tissue injury, the start of an infection or other cause of inflammation. Increased levels can be after a trauma or heart attack, autoimmune disorders and bacterial infections.

**Vitamin D** is a vitamin that helps to regulate blood levels of calcium, phosphorus and magnesium. It is vital for the growth and health of bones in the body and helps to regulate the immune system as well.

## **Thyroid Tests**

**T-4 or thyroxine** is a very important hormone that maintains body temperature, regulates heart rate and stimulates metabolic activity in general through its involvement in using nutrients. Increases in T-4 can cause nervousness, palpitations, sweating, sleep disorders and weight loss. Decreases in T-4 may cause intolerance to cold, dry skin, fatigue and weight gain.

**T-3 Uptake** estimates how many of the available binding sites for this thyroid hormone are used up. This test should be viewed in the context of the other thyroid tests, but in general, lower values are seen in hypothyroidism and higher values in hyperthyroidism.

**FTI or Free Thyroxine Index** provides an estimate of how much T-4 is in the free or active state. It is a useful index of hormonal levels and again low values are often associated with hypothyroid tendencies and high values with hyperthyroid tendencies.

**TSH or Thyroid Stimulating Hormone** is produced by the pituitary gland and sends a signal to the thyroid gland to produce more T-4 and T-3. This reflects how well the thyroid is responding to the pituitary and also how well the pituitary is working. It is part of the feedback mechanism that insures a proper metabolic rate.

## **Blood Cell Counts**

**White Blood Cells (WBC)** represent the body's immune system and the kinds of white cells have specialized functions. Lymphocytes are mainly for defense against virus and cancer cells, while Polys are primarily defending against bacteria. Monocytes are the second line of defense and are seen in higher numbers when there is infection or inflammation. Basophils primarily function as clean-up for allergy reactions and Eosinophils perform a service when toxins, allergens and parasites attack.

**Red Blood Cells** are the oxygen carrying cells using Hemoglobin to hold the oxygen until exchanged for carbon dioxide. Hematocrit is a measure of the volume of whole blood taken up by the red blood cells and expressed as a percent. MCV, MHC, MCV and RDW all reflect the size, shape and contents of red cells.

**Platelets** are special cells in the blood that help form clots when repair is necessary.

## **Urinalysis**

The urine is analyzed to determine how concentrated it is through Specific Gravity, which tells us how "heavy" it is compared to water. The pH is very important because it measures how acidic or alkaline the tissues of the body are. WBC Esterase tells whether there are white blood cells in the urine, and Occult Blood indicates the presence of blood (may be due to menstruation). Nitrite is a sign of infection, while Glucose in the urine may indicate diabetes. Ketones can also indicate diabetes, but may be due to a low carbohydrate diet or fasting. Protein may "leak" through the kidney and show a possible weakness in that organ. Bilirubin is normally eliminated through the bile and its presence in the urine may be a sign of liver problems. Urobilinogen is a by-product of intestinal activity and may show a lack of bowel flora.