Chemical components

• Sugar

The occurance of sugar in the urine indicates to *Diabetes mellitus* should be suspected, and test for urinary sugar are commoly used for the diagnosis and management of this disease. The type of sugar that is present in the urine in case of *Diabetes mellitus* is glucose which also called dextrose. Any case in which glucose is present in urine is termed glycosuria or glucosuria. Also the glucosuria may be caused from another reasonse than *Diabetes mellitus* which are:

1-Endocrinological defect: (i.e. acromegaly, Cushing syndrome and hyperthyroidism).
2-Pancrease defect, like cystic fibrosis in early stages. Chronic pancrease infection and cancer.
3- Hpothalamus defect.
4- Metabolic defect in the body as result of liver disease and cardiogenic shock.
5- Some drugs which are caused hyperglycemia like glucocorticoid, ACTH and oral contraceptive.
6- Pregnancy occasionally.
7- Renal tubule failure.

The test of glucose in urine based on the reducing ability of glucose for some indicators used. The glucose or any compound with free aldehyde or ketone group has the ability to acting as reducing agent for heavy metal such as copper 1 irons are reduction to copper I irons.

• Protien

The presence of protein in urine correlated with renal disease or with finding in the urinary sediment. In the cases of renal disease, it is essential that the diagnosis be made and treatment started as soon as possible to prevent extensive and permanent renal damage.

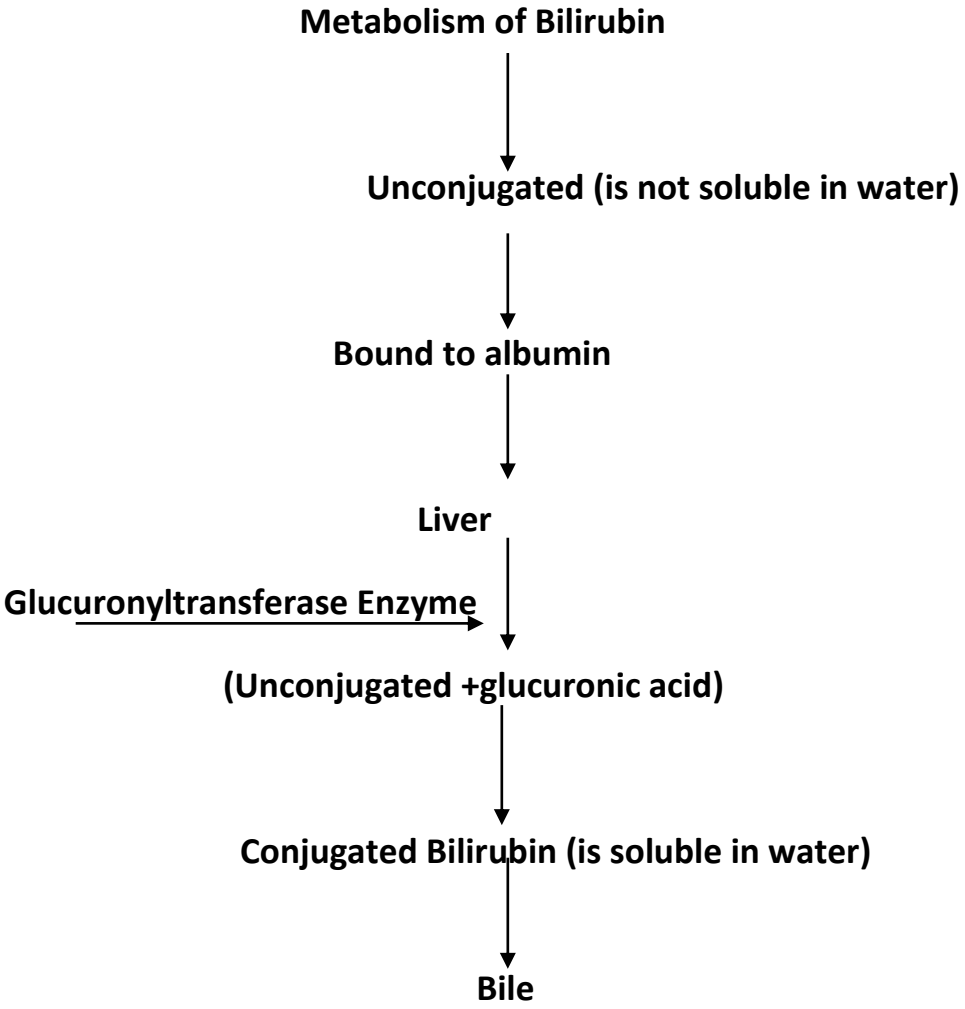
The initial stage in the formation of urine is an ultrafiltration (glomerular filtrate) of plasma without the large protein molecules and certain fatty substances. It the glomerular capsule is damage, protein molecules can pass through tubules and end up in the urine. Also in normal case all of this protein was reabsorbed back in to blood stream through the renal convoluted tubules. There is a correlation between the presence of cast in the urinary sediment and proteinuria, since casts are

made of precipitated protein. The occurance of casts with proteinuria distinguishes an upper urinary tract (kidneys) disorder from a lower urinary tract disorder.

Bacterial infections of the kidney are often indicated by the presence of pus cells and bacteria in the urine sedimentation in addition to protein in the urine. In these cases, the amount of protein excreted is usually fairly small. Pus cells and bacteria in the urinary sediment with the absene of urinary protein probably indicate to lower urinary tract infection without renal involvement.

- **Bilirubin**

Is the yellow breakdown product of normal heme catabolism. Heme is found in hemoglobin, a principal component of red blood cells. Bilirubin is excreted in bile and urine, and elevated levels may indicate certain diseases. It is responsible for the yellow color of urine, and the yellow discoloration in jaundice.



• Urobilinogen

Urobilinogen is a by-product of red blood cell degradation and result from intestinal reduction of bilirubin.

Increased destruction of R.B.Cs may be accompanied by large amount of Urobilinogen in the urine. Therefore, Urobilinogen will be seen in hemolytic anemia and malaria infection.

In the absent of increased red cell destruction, the test may be considered liver function test. The effect of liver damage is impairment of the mechanism for removing urobilinogen from blood circulation and excreting it through the intestine. This results in removal of urobilinogen by the kidneys and its presence in urine.

• Jaundice

Is a condition that occurs when the serum bilirubin concentration becomes greater than normal and there is an abnormal accumulation of bilirubin in the body tissue, like skin, the mucous membrane and sclera.

Classification of jaundice:

1- Prehepatic jaundice (hemolytic jaundice)

In occurs in condition where there is increased destruction of R.B.Cs for instance, in infants with blood group incompatibilities in neonatal physiological jaundice and in hemolytic anemia. The liver is basically normal, so there is an increased formation of conjugated bilirubin and subsequently of urobilinogen. This kind of jaundice is characterized by increased free bilirubin in the blood and increased urobilinogen in stool and urine.

2- Hepatic jaundice

It results from condition that involves the liver cells directly, preventing normal excretion. It can be caused by specific damage such as conjugation failure in neonatal physiological jaundice, where there is an enzyme deficiency. Diseases of conjugation failure result in increased concentration of unconjugation bilirubin in the blood and then in urine. Also the causes of this kind of jaundice in such condition as viral hepatitis toxic hepatitis from heavy metal or drug poisoning and cirrhosis.

3- Posthepatic or obstructive jaundice

It occurs when the common bile duct is obstructed by stones, tumors, spasms or stricture. As a result, the conjugated bilirubin is regurgitated back in to the liver sinusoids and the blood. It the blockage

is sufficiently extensive, liver cell function may be impaired so that both free and conjugated bilirubins are found in blood. The conjugated bilirubin will be excreted by the kidney and therefore found in the urine. Since conjugated is unable to reach the intestine, no urobilinogen is formed and it is absent in the blood and urine. Urobilinogen is absent and the stool because not formed urobilinogen.

Urine containing bilirubin will typically have a brown colour. Bilirubin is not stable in solution but will be oxidized to biliverdin, which is green pigment. So that the colour of urine contain bilirubin at the time of voided is brown it become green on standing.

- **Ketone bodies**

In fat catabolism (the phase of metabolism in which fats are broken down for energy), acetic acid is produced firstly it is converted to either β-hydroxybutyric acid or acetone. All these three ketone bodies are utilized by muscle tissues as a source of energy.

The cause of ketone bodies presence in urine involves:

1- *Diabetes mellitus*.

2-Another cause include.

A-Acute fever.

B-Poisoning associated with vomiting and diarrhea.

C-Weakness associated with vomiting.

D-Vomiting associated with anesthesia.

F-Glucose consumption defect.

- **Urine Culture**

For purpose of investigation of Urinary tract infections (UTI) collected samples urine form midstream urine to reduce the contamination with normal microflora or genitourinary tract and to avoid contamination with exogenous bacteria through collected wash area around urinary tract, however we find that urine contaminated usually by bacteria exogenous through excretion out of body via urethra, especially in females because anatomy of urinary system and in addition to near opening urethra from genital opening, therefore **it is recommended to study culturing of urine from quantity and quality,** the presence of large numbers of microorganism specific is evidence of infection, but the presence of a few numbers from it indicated

contaminate occurred during collection sample, and generally indicates found number (10^5 cell bacteria /1ml) in urine indicates lead to cause urine tract infections. The samples generally are cultured on media such as blood agar and selective media including Macconkey agar and Mannitol salt agar and Eosine methylene Blue agar. The bacteria caused common that causing infections of urinary tract types belonging to : *Escherichia coli, Klebsiella, Proteus, Pseudomonas, Salmonlla, Serratia, Streptococcus, Staphylococcus* and the Gram negative enteric bacteria from more risk factors for infections of urinary system.

Biochemical Test: A biochemical test refers to the chemical identification of unknown substances within a living thing. The test quantitatively and qualitatively determines a particular substance like an enzyme within the blood. A biochemical test can be used to diagnose a given disease. Clinical chemistry (also known as chemical pathology, clinical biochemistry or medical biochemistry) is the area of clinical pathology that is generally concerned with analysis of bodily fluids. Most current laboratories are now highly automated to accommodate the high workload typical of a hospital laboratory. All biochemical tests come under chemical pathology. These are performed on any kind of body fluid, but mostly on serum or plasma. Such as urea, creatinine, Bilirubin, Albumin, Uric Acid, Cholesterol, Triglycerides

Renal function tests total

Include a group from tests for assessing effectiveness kidney of filtration several metabolites (waste products) and secretion in the urine, such as creatinine, urea and uric acid as shown below:

1- Creatinine test

The liver synthesized material creatinine from some amino acids and then transferred to skeletal muscles and then converted to a compound phosphoryl creatine, which storage for energy in muscles which contraction when performing exercises released creatinine to blood stream and then to kidney to be filtration with urine so it can be

use of concentration creatinine in plasma blood as an indicator of efficiency kidney in filter metabolize proteins. The creatinine level in the blood is different between men and women **because the difference amount of skeletal muscles between them**, the normal concentration in women ranges from 0.5-1 mg / dl compared while, in men range 0.7-1.4 mg / dl. **The body builder men, the level of creatinine 2 mg / dl without any indication of kidney disease**, this is reversal in vegetarian's people (who only food on plant but not eaten meat or animal products) have small amounts of creatinine in the blood, and generally indicates the high level of creatinine in blood plasma from normal limit to kidney disease, while the lower level of **Creatinine** to some modern research leading to increase infect risk with diabetes DM type II in men.

2-Urea test

Urea is one produce of protein and are formation in liver by remove an amino group (Deamination) from amino acids and then release to bloodstream where it works kidney filtration with urine to keep concentration in plasma blood its normal and limit from 20-45 mg / dl. When the urea is increse lead to cause blood poisoning or called uremia or azotemia, which begins symptoms loss of appetite and lethargy which is then developed up to weakness of mental ability and coma and mainly kidney failure. Increasing of urea production in liver is as eating food rich in proteins (meat mostly) or other reasons.

3- Uric acid test

Uric acid produces from breakdown nitrogen base type purines composed of both DNA and RNA in liver as well as by synthesized directly from some amino acids and release to circulation blood and to kidney which removal with urine to maintain normal limits in blood plasma between 3.6- 8.3 mg / dl and called case of high level limit normal **Hyperuricemia** but lower level than minimum is called **Hpourecimia**, is case of high concentration in blood plasma is most dangerous its lead to **gout** this is as increase taking person's food rich in

purines such as meat animals and seeds and grains), or because of kidney failure. The uric acid accoumaltion in the blood is which lead to crystals conformations of urate in the blood and then precipitate in joints as well as in the kidney forming urate stone.

Cholesterol, Triglycerides (Lipoproteins) and the Liver

Lipids are transported in the circulation packaged in **lipoproteins**. The clinical relevance of blood lipid levels is that abnormal levels of lipids in certain lipoproteins are linked to an increase risk of **atherosclerosis**. Atherosclerosis is a cardiovascular disease in which lipids and inflammatory cells accumulate in plaques within the walls of blood vessels. As a result, vessel walls are narrowed and clots may form, impeding blood flow and oxygen delivery and causing tissue injury. Heart disease occurs because the coronary arteries supplying the heart are a major site where atherosclerotic plaques form.

The liver is central to the regulation of cholesterol levels in the body. Not only does it synthesize cholesterol for export to other cells, but it also removes cholesterol from the body by converting it to bile salts and putting it into the bile where it can be eliminated in the feces. Furthermore, the liver synthesizes the various lipoproteins involved in transporting cholesterol and other lipids throughout the body.

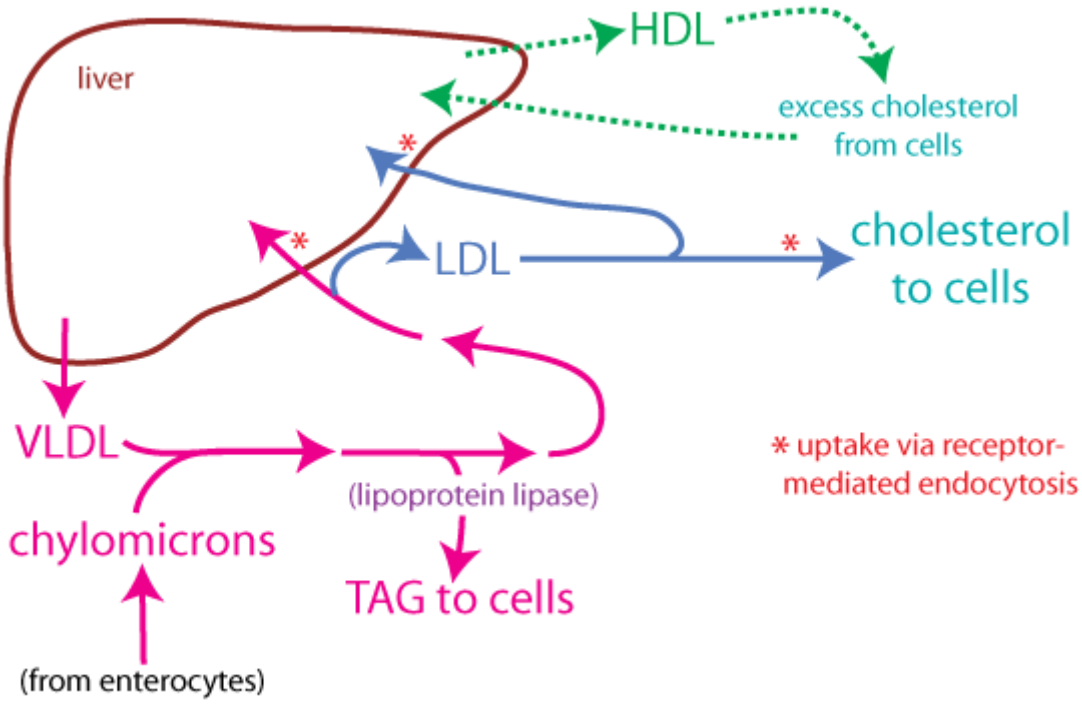
Cholesterol synthesis in the liver is under *negative feedback regulation*. Increased cholesterol in a hepatocyte leads to decreased activity of **HMG-CoA reductase**, the rate-limiting enzyme in cholesterol synthesis.

Types of Lipoproteins

Lipoproteins are particles that contain triacylglycerol (TAG), cholesterol, phospholipids and amphipathic proteins called **apolipoproteins**. Lipoproteins can be differentiated on the basis of their density, but also by the types of apolipoproteins they contain. The degree of lipid in a lipoprotein affects its density—the lower the density of a lipoprotein, the more lipid it contains relative to protein. The four major types of

lipoproteins are **chylomicrons**, **very low-density lipoprotein** (**VLDL**), **low-density lipoprotein** (**LDL**), and **high-density lipoprotein** (**HDL**).

The figure below summarizes the fates of lipoproteins produced by the liver. Refer to it as you read about the different lipoproteins.



- **Chylomicrons and VLDL deliver TAG to cells in the body.** Two types of lipoproteins are triglyceride-rich: the chylomicrons and VLDL. Chylomicrons are synthesized by enterocytes from lipids absorbed in the small intestine. VLDL is synthesized in the liver. The function of these lipoproteins is to deliver energy-rich triacylglycerol (TAG) to cells in the body (pink pathway). TAG is stripped from chylomicrons and VLDL through the action of **lipoprotein lipase**, an enzyme that is found on the surface of endothelial cells. This enzyme digests the TAG to fatty acids and monoglycerides, which can then diffuse into the cell to be oxidized, or in the case of an adipose cell, to be re-synthesized into TAG and stored in the cell.

- **LDL delivers cholesterol to cells in the body.** As VLDL particles are stripped of triacylglycerol, they become denser. These particles are remodeled at the liver and transformed into LDL. The function of LDL is to deliver cholesterol to cells, where it is used in membranes, or for the synthesis of steroid hormones (blue pathway). Cells take up cholesterol by **receptor-mediated endocytosis**. LDL binds to a specific **LDL receptor** and is internalized in an endocytic vesicle. Receptors are recycled to the cell surface, while hydrolysis in an endolysosome releases cholesterol for use in the cell.
- **HDL is involved in reverse cholesterol transport.** Excess cholesterol is eliminated from the body via the liver, which secretes cholesterol in bile or converts it to bile salts. The liver removes LDL and other lipoproteins from the circulation by receptor-mediated endocytosis. Additionally, excess cholesterol from cells is brought back to the liver by HDL in a process known as **reverse cholesterol transport** (green pathway). HDL (or really, the HDL precursor) is synthesized and secreted by the liver and small intestine. It travels in the circulation where it gathers cholesterol to form mature HDL, which then returns the cholesterol to the liver via various pathways.

Disorders and Drug Treatments

The link between cholesterol and heart disease was recognized through the study of individuals with **familial hypercholesterolemia**. Individuals with this disorder have several-fold higher levels of circulating LDL due to a defect in the function of their LDL receptors. Without functioning LDL receptors, LDL is not cleared from the circulation. As well, because cholesterol cannot get into cells efficiently, there is no negative feedback suppression of cholesterol synthesis in the liver. Individuals with familial hypercholesterolemia may have strokes and heart attacks starting in their 30's.

More common in the general population is **dyslipidemia**, which is the term that is used if lipid levels are outside the normal range. In a typical lipid profile, the fasting levels of total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides are determined. High levels of LDL cholesterol (the so-called “bad cholesterol”) greatly increase the risk for

atherosclerosis because LDL particles contribute to the formation of atherosclerotic plaques. Low levels of HDL cholesterol (the so-called "good cholesterol") are an independent risk factor, because reverse cholesterol transport works to prevent plaque formation, or may even cause regression of plaques once they have formed. HDL may also have anti-inflammatory properties that help reduce the risk of atherosclerosis. Fasting triglyceride levels are used to estimate the level of VLDL. High levels of triglycerides are also associated with an increased risk for atherosclerosis, although the mechanism is not entirely clear.

The most important drugs for the treatment of dyslipidemia are by far, the statins. Statins have been shown in multiple clinical trials to reduce cardiovascular events and mortality.

Statins

These drugs inhibit 3- hydroxyl-3-methyglutaryl reductase (**HMG-CoA reductase)**, the rate-limiting enzyme in cholesterol synthesis. They are designed to mainly inhibit HMG-CoA reductase in the liver. Inhibition of cholesterol synthesis further decreases circulating LDL because reduced levels of cholesterol in the hepatocyte cause it to upregulate expression of LDL receptors.

In the past, several different drugs have been used to treat dyslipidemia, however the most recent treatment guidelines recommend mainly statin therapy at different intensities according to the patient's risk for cardiovascular disease. However, statins may cause adverse effects in some patients, or in others, statins by themselves may not provide sufficient lowering of LDL cholesterol. These patients may benefit from the use of the other two drugs listed below.

PCSK9 inhibitors

PCSK9* is a secreted protein that binds to LDL receptors and targets them for breakdown. PCSK9 inhibitors are monoclonal antibody drugs that bind to PCSK9 and block its ability to cause LDL receptor degradation. They lower LDL cholesterol because with increased numbers of LDL receptors, more LDL can be removed from the circulation.

Two PCSK9 inhibitor drugs were approved in 2015: alirocumab (tradename: Praluent) and evolocumab (tradename: Repatha). Because they are monoclonal antibody drugs, they must be administered by injection. These drugs have been approved as a second-line treatment for patients who can't tolerate statins, or who are unable to get effective lowering of LDL cholesterol by using a statin alone. For instance, patients with familial hypercholesterolemia are good candidates for treatment with a PCSK9 inhibitor. In clinical trials, these drugs were able to substantially lower LDL cholesterol. Trials are ongoing to determine if PCSK9 inhibitors lower cardiovascular events such as heart attack and stroke.

*PCSK9 stands for proprotein convertase subtilisin/kexin type 9.

Ezetimibe

Ezetimibe inhibits cholesterol absorption in the small intestine. This reduces absorption of dietary cholesterol, but also promotes cholesterol excretion, since biliary cholesterol accounts for some of the cholesterol that passes through the small intestine. Ezetimibe effectively lowers LDL cholesterol, and, when paired with a statin, can provide the same degree of cholesterol lowering with a lower dose of statin. The most recent results of a large clinical trial testing the combination of ezetimibe with a statin (IMPROVE-IT trial) has shown that it has a modest benefit in reducing heart disease.

What are liver function tests?

Liver function tests, also known as liver chemistries, help determine the

health of your liver by measuring the levels of proteins, liver enzymes,

and bilirubin in your blood.

A liver function test is often recommended in the following situations:

- to check for damage from liver infections, such as hepatitis B and hepatitis C

- to monitor the side effects of certain medications known to affect the liver
- if you already have a liver disease, to monitor the disease and how well a particular treatment is working
- if you're experiencing the symptoms of a liver disorder
- if you have certain medical conditions such as high triglycerides, diabetes, high blood pressure, or anemia
- if you drink alcohol heavily
- if you have gallbladder disease

Many tests can be performed on the liver. Certain tests can reflect different aspects of liver function.

Commonly used tests to check liver abnormalities are tests checking:

- alanine transaminase (ALT)
- aspartate aminotransferase (AST)
- alkaline phosphatase (ALP)
- albumin
- bilirubin

The ALT and AST tests measure enzymes that your liver releases in response to damage or disease. The albumin test measures how well the liver creates albumin, while the bilirubin test measures how well it disposes of bilirubin. ALP can be used to evaluate the bile duct system of the liver.

Having abnormal results on any of these liver tests typically requires follow up to determine the cause of the abnormalities. Even mildly elevated results can be associated with liver disease. However, these enzymes can also be found in other places besides the liver.

Talk to your doctor about the results of your liver function test and what they may mean for you.

What are the most common liver function tests?

Liver function tests are used to measure specific enzymes and proteins in your blood.

Depending on the test, either higher- or lower-than-normal levels of these enzymes or proteins can indicate a problem with your liver.

Some common liver function tests include:

1-Alanine transaminase (ALT) test

Alanine transaminase (ALT) is used by your body to metabolize protein. If the liver is damaged or not functioning properly, ALT can be released into the blood. This causes ALT levels to increase. A higher than normal result on this test can be a sign of liver damage. According to the American College of Gastroenterology, an ALT above 25 IU/L (international units per liter) in females and 33 IU/L in males typically requires further testing and evaluation.

2-Aspartate aminotransferase (AST) test

Aspartate aminotransferase (AST) is an enzyme found in several parts of your body, including the heart, liver, and muscles. Since AST levels aren't as specific for liver damage as ALT, it's usually measured together with ALT to check for liver problems. When the liver is damaged, AST can be released into the bloodstream. A high result on an AST test might indicate a problem with the liver or muscles. The normal range for AST is typically up to 40 IU/L in adults and may be higher in infants and young children.

3-Alkaline phosphatase (ALP) test

Alkaline phosphatase (ALP) is an enzyme found in your bones, bile ducts, and liver. An ALP test is typically ordered in combination with several other tests. High levels of ALP may indicate liver inflammation, blockage

of the bile ducts, or a bone disease. Children and adolescents may have elevated levels of ALP because their bones are growing. Pregnancy can also raise ALP levels. The normal range for ALP is typically up to 120 U/L in adults.

Albumin test

Albumin is the main protein made by your liver. It performs many important bodily functions. For example, albumin:

- stops fluid from leaking out of your blood vessels
- nourishes your tissues
- transports hormones, vitamins, and other substances throughout your body

An albumin test measures how well your liver is making this particular protein. A low result on this test can indicate that your liver isn't functioning properly. The normal range for albumin is 3.5–5.0 grams per deciliter (g/dL). However, low albumin can also be a result of poor nutrition, kidney disease, infection, and inflammation.

Why do I need a liver function test?

Liver tests can help determine if your liver is working correctly. The liver performs a number of vital bodily functions, such as:

- removing contaminants from your blood
- converting nutrients from the foods you eat
- storing minerals and vitamins
- regulating blood clotting
- producing cholesterol, proteins, enzymes, and bile

- making factors that fight infection
- removing bacteria from your blood
- processing substances that could harm your body
- maintaining hormone balances
- regulating blood sugar levels

Problems with the liver can make a person very sick and can even be life-threatening.

What are the symptoms of a liver disorder?

Symptoms of a liver disorder include:

- weakness
- fatigue or loss of energy
- weight loss
- jaundice (yellow skin and eyes)
- fluid collection in the abdomen, known as ascites
- discolored bodily discharge (dark urine or light stools)
- nausea
- vomiting
- diarrhea
- abdominal pain
- abnormal bruising or bleeding

Your doctor may order a liver function test if you're experiencing symptoms of a liver disorder. The different liver function tests can also monitor the progression or treatment of a disease and test for the side effects of certain medications.

The following beneficial ingredients can be found in Livergenex:

- **Vitamin C** – which boosts energy levels, but also targets liver and gallbladder disease as well as medication toxicity
- **Vitamins B1 & B6** – which target medication toxicity and help improve nonalcoholic fatty liver disease
- **N-Acetyl-L-Cysteine** – typically used to detoxify the liver, support the prevention of alcoholic liver damage, and reduce the toxicity of environmental chemicals such as insecticides
- **Milk Thistle** – a potent herb that is commonly used for chronic inflammatory liver disease, hepatic cirrhosis, chronic hepatitis, and toxic liver damage that is caused by chemical exposure
- **Turmeric** – a powerful herb that targets gallbladder and liver diseases such as fatty liver disease as well as toxic hepatitis
- **Artichoke Leaf** – commonly used for a fatty liver or an alcohol-induced liver injury
- **Resveratrol** – improves fatty liver disease and also helps protect the liver from chemical exposure or alcohol injury
- **Alpha Lipoic Acid** – targets nonalcoholic liver disease and Wilson's Disease