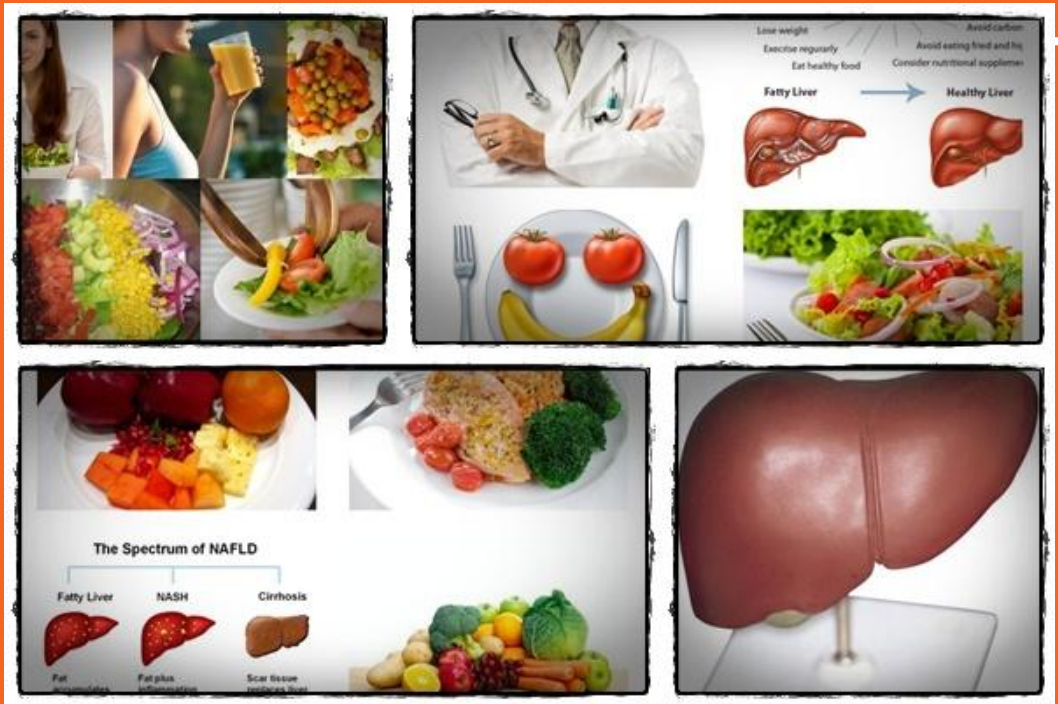


Diet in liver diseases: Cirrhosis,Hepatitis,Hepatic coma

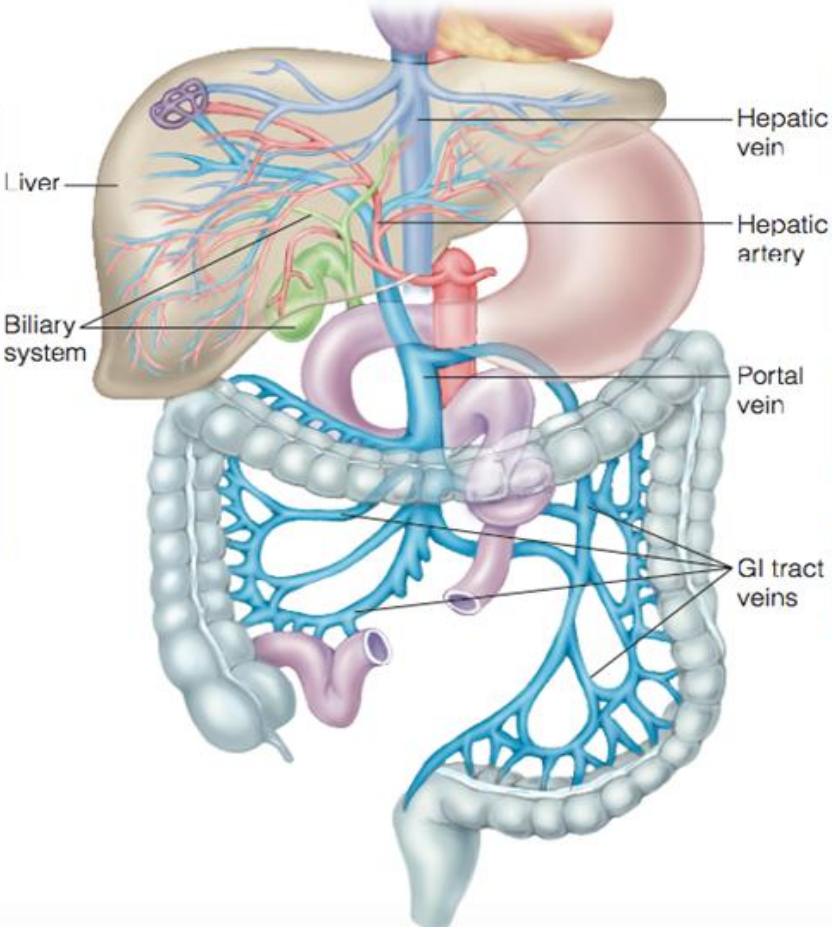
Liver

- The liver is the most metabolically active organ in the body.
- It is located in the upper right hand side of the abdomen, mostly behind the rib cage.
- The liver of an adult normally weighs close to three pounds and has many functions.
- It plays a central role in processing, storing and redistributing the nutrients provided by the foods we eat.
- More than 500 functions have been identified and no other organ is concerned with so many functions

Figure 1 Gross Anatomy of the Hepatobiliary System

Liver
Receives nutrients from the digestive tract and processes them for distribution throughout the body.

Biliary system
Includes the gallbladder, which stores and secretes bile, and the bile ducts, which conduct bile from the liver to the gallbladder from the gallbladder to the intestine.



Hepatic vein
Returns blood from the liver to the heart.

Hepatic artery
Supplies oxygen-rich blood from the heart to the liver.

Portal vein
Carries nutrient-rich blood from the digestive tract to the liver.

GI tract veins
Transport absorbed nutrients to the portal vein.

Functions of liver

The primary functions of the liver are:

- Bile production and excretion.
- Excretion of bilirubin, cholesterol, hormones, and drugs.
- Metabolism of fats, proteins, and carbohydrates.
- Enzyme activation.
- Storage of glycogen, vitamins, and minerals.
- Synthesis of plasma proteins, such as albumin, and clotting factors.
-

Metabolic Functions	
Carbohydrate Metabolism	Glycogenesis, gluconeogenesis, oxidation via TCA cycle, glycogenolysis, glycolysis
Lipid Metabolism	Lipogenesis, lipolysis, saturation/desaturation, ketogenesis, esterification of fatty acids, fatty acid oxidation, uptake/formation/breakdown of phosphotides, synthesis/degradation/esterification/ excretion of cholesterol, formation of lipoproteins
Protein Metabolism	Synthesis of serum proteins, synthesis of prothrombin, globin of hemoglobin, apoferritin, nucleoproteins and serum mucoprotein, degradation of some proteins to peptides and amino acids, synthesis of urea
Enzyme Metabolism	Synthesis of alkaline phosphatase, mono-amine oxidases (MAOs), acetylcholine esterase, oxidases, cholesterol esterase, dehydrogenases, beta glucuronidase, glutamic oxalacetic transaminase (SGOT-AST), and glutamic pyruvic transaminase (SPGT-ALT)
Vitamin Metabolism	Formation of acetyl CoA from pantothenic acid, hydroxylation of vitamin D to 25-OH D_3, formation of 5-methyl tetrahydrofolic acid (THFA), methylation of niacinamide, phosphorylation of pyridoxine, dephosphorylation of thiamin, formation of coenzyme B_{12}
Bile Acid Metabolism	Transformation of cholesterol to 7-hydroxycholesterol to cholic acid and chenodeoxycholic acid
Heme Metabolism	Heme is oxidized to biliverdin, which is then reduced to bilirubin; bilirubin is transported to the liver where it is converted to bilirubin diglucuronide to be excreted with the bile pigments
Storage	Storage of glycogen, fats, fatty acids, and fat-soluble vitamins
Other Functions	Conjugation, detoxification and degradation, reticuloendothelial system (RES) activity, water movement regulation, fetal hematopoiesis, excretion

Meaning of liver disease

- Types of liver diseases: Cirrhosis, Hepatitis, Hepatic coma
- Since liver is responsible for many critical functions within the body and should it become diseased or injured, the loss of those functions can cause significant damage to the body. Liver disease is also referred to as hepatic disease.
- Liver disease is a broad term that covers all the potential problems that cause the liver to fail to perform its designated functions. Usually, more than 75% or three quarters of liver tissue needs to be affected before a decrease in function occurs.
-

How liver can be damaged?

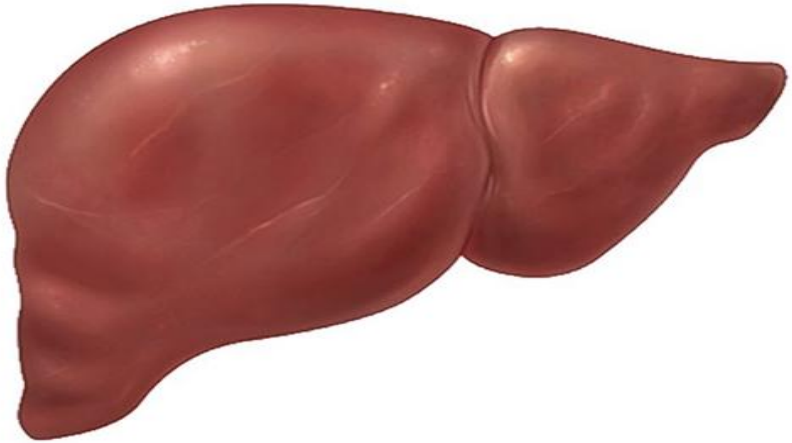
The liver can be damaged in a variety of ways.

- Cells can become inflamed, for example, hepatitis.
- Bile flow can be obstructed, for example, cholestasis).
- Cholesterol or triglycerides can accumulate, for example, steatosis).
- Blood flow to the liver may be compromised.
- Liver tissue can be damaged by chemicals and minerals, or infiltrated by abnormal cells, like cancer cells.

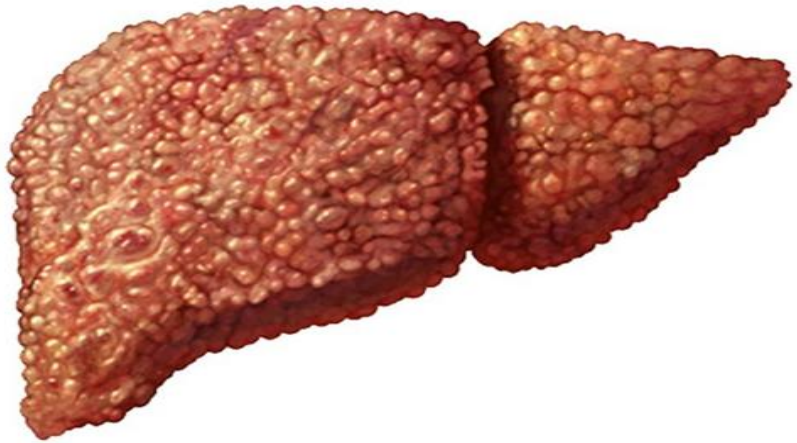
Cirrhosis

- Cirrhosis is a late-stage of liver disease.
- It is a slowly progressing disease in which healthy liver tissue is replaced with scar tissue, eventually preventing the liver from functioning properly. The scar tissue blocks the flow of blood through the liver and slows the processing of nutrients, hormones, drugs, and naturally produced toxins. It also slows the production of proteins and other substances made by the liver.
- Scarring of the liver and loss of functioning liver cells cause the liver to fail. Significant amounts of liver cells need to be damaged before the hole organ fails to function

Normal Liver



Liver with Cirrhosis



What causes cirrhosis of the liver?

Hepatitis C, fatty liver, and alcohol abuse are the most common causes of cirrhosis of the liver in the U.S., but anything that damages the liver can cause cirrhosis, including:

- ✔ Fatty liver associated with obesity and diabetes
- ✔ Chronic viral infections of the liver (hepatitis types B, C, and D; Hepatitis D is extremely rare)
- ✔ Blockage of the bile duct, which carries bile formed in the liver to the intestines, where it helps in the digestion of fats

What are the symptoms of cirrhosis of the liver?

The symptoms of cirrhosis of the liver vary with the stage of the illness. In the beginning stages, there may not be any symptoms. As the disease worsens, symptoms may include:

- Loss of appetite
- Lack of energy (fatigue), which may be debilitating
- Weight loss or sudden weight gain
- Bruises
- Yellowing of skin or the whites of eyes (jaundice)
- Itchy skin
- Fluid retention (edema) and swelling in the ankles, legs, and abdomen (often an early sign)
- Blood in the stool
- Fever

Complications: Hepatic encephalopathy results from Increased ammonia levels due to the liver's inability to process and metabolize proteins in the diet can cause confusion, lethargy and coma

Complications:

- Hepatic encephalopathy results from Increased ammonia levels due to the liver's inability to process and metabolize proteins in the diet can cause confusion, lethargy and coma
- Hemorrhage
- Acute renal failure
- Hepatocellular carcinoma

Nutritional consideration in liver cirrhosis

- *Medication:* The typical management of cirrhosis involves medications (eg, lactulose) that decrease the absorption of ammonia, a compound that is a main cause of hepatic encephalopathy.
- *Calorie*: Malnutrition, a common complication in liver cirrhosis, is associated with poorer outcome. Consequently, a diet that provides 25 to 40 kcal/kg body weight a day is usually prescribed

- Vegetarian diet: Dietary changes, such as the use of vegetable protein instead of animal protein, may also lower blood ammonia levels. Plant-based diets have more dietary fiber, which may reduce ammonia-related encephalopathy in two ways: first, by enhancing the use of nitrogen by colonic bacteria; and second, by facilitating nitrogen removal from the body by speeding food remnants through the intestines. Vegetable protein sources are also higher in arginine, an amino acid that decreases blood ammonia levels through increasing urea synthesis. They are also lower in methionine and tryptophan, amino acids that exacerbate encephalopathy through gut conversion to neurotoxic metabolites (mercaptans and oxyphenol, respectively).

Top 10 Sources of Veggie Protein

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Where do you get your protein?

(brought to you by The GIVE Project)

the GIVE project
thegiveproject.org
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Spinach
49% protein

Kale
45% protein

Broccoli
45% protein

Cauliflower
40% protein

Mushrooms
38% protein

Parsley
34% protein

Cucumbers
24% protein

Green Pepper
22% protein

Cabbage
22% protein

Tomatoes
18% protein

Protein in Meat:

Beef
25.8% protein

Chicken
23% protein

Eggs
12% protein

- *Branched-chain amino acids:* Nutrition therapy, particularly with branched-chain amino acids, can also help support patients who are losing weight due to poor appetite and may improve survival.
- *Sodium restricted diet*: A sodium-restricted diet is standard treatment. A 2000 mg sodium-restricted diet is effective, when combined with diuretic therapy, for controlling fluid overload in 90% of patients with cirrhosis and ascites.

- *Low fat diets*: Several investigations have concluded that excess dietary fat may encourage cirrhosis progression. High intakes of total fat, saturated fat, and polyunsaturated fat have been implicated.

HEPATITIS

Hepatitis is an inflammation of the liver. It is caused by viruses or toxic agents such as drugs and alcohol. **Necrosis** occurs, and the liver's normal metabolic activities are constricted. Hepatitis may be acute or chronic.

In mild cases, the cells can be replaced. In severe cases, the damage can be so extensive that the necrosis leads to liver failure and death. There can be bile **stasis** and decreased blood albumin levels. Clients experience nausea, headache, fever, fatigue, tender and enlarged liver, anorexia, and **jaundice**. Weight loss can be pronounced.

Causes of hepatitis

Hepatitis A virus (HAV) is contracted through contaminated drinking water, food, and sewage via a fecal–oral route. Hepatitis B virus (HBV) and hepatitis C virus (HCV) are transmitted through blood, blood products, semen, and saliva. Hepatitis B and C can lead to chronic active hepatitis (CAH), which is diagnosed by liver biopsy. Chronic active hepatitis can lead to liver failure and end-stage liver disease (ESLD).

Treatment of Hepatitis

Hepatitis is treated with supportive care, such as bed rest (if necessary) and an appropriate diet. Hepatitis patients should avoid substances that irritate the liver, such as alcohol, drugs, and dietary supplements that cause liver damage. Hepatitis A infection usually resolves without the use of medications, whereas antiviral drugs may be used to treat HBV and HCV infections. Nonviral forms of hepatitis may be treated with anti-inflammatory and immunosuppressant drugs. Hospitalization is not required for hepatitis unless other medical conditions or complications hamper recovery.

Nutrition care varies according to a patient's symptoms and nutrition status. Most individuals require no dietary changes. Those with anorexia or abdominal discomfort may find small, frequent meals easier to tolerate. Patients with persistent vomiting may require fluid and electrolyte replacement. Malnourished individuals need to consume adequate protein and energy to replenish nutrient stores; the diet should include about 1.0 to 1.2 grams of protein per kilogram of body weight each day.* Oral supplements can be helpful for improving nutrient intakes.