



HCSP FACT SHEET

HCV ADVOCATE

• HCV AND THE LIVER •

An Overview of the Liver

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Foreword

The liver is the largest internal organ. It is reddish-brown, weighs approximately three pounds (in the adult male) and is about the size of a football. It is located behind the ribcage on the upper right side of the abdomen. The liver has the unique ability to regenerate its own tissue—as much as three-quarters of the liver can be lost, and the organ can grow back or expand to its original size within several weeks. This allows people who need transplants to receive part of a living or deceased donor's liver.

The liver is divided into four lobes; these are in turn composed of multiple lobules which contain the hepatocytes, or working liver cells. The liver has an extensive blood supply—about 1½ quarts of blood flow through it every minute. It receives oxygen-rich blood from the hepatic artery. The portal vein delivers blood containing nutrients, toxins, and other substances absorbed from the intestines to the liver. The liver filters this blood, then sends it on to the heart via the hepatic vein.

Functions of the Liver

The liver is responsible for some 500 bodily functions. It plays a role in digestion, sugar and fat metabolism, and the body's immune defense. It processes almost everything a person eats, breathes, or absorbs through the skin. About 90% of the body's nutrients pass through the liver from the intestines. The liver converts food into energy, stores nutrients, and produces blood proteins. The liver also acts as a filter to remove harmful substances from the blood. In the developing fetus, blood cells are produced in the liver.

Digestion

The liver plays an important role in the digestion and processing of food. Liver cells produce bile, a greenish-yellow fluid that aids the digestion of fats and the absorption of fat-soluble nutrients. Bile is delivered to the

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The information in this fact sheet is designed to help you understand and manage HCV and is not intended as medical advice. All persons with HCV should consult a medical practitioner for diagnosis and treatment of HCV.

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small intestine through the bile duct; when there is no food to digest, extra bile is stored in a small organ called the gallbladder located beneath the liver. By-products from the breakdown of drugs and toxic substances processed by the liver are carried in the bile and excreted from the body. A person with a damaged liver may experience impaired bile production and flow. When this happens, the body may not be able to properly absorb nutrients. Liver cells also convert heme (a component of hemoglobin that is released when red blood cells are broken down) into bilirubin. When the liver is damaged, bilirubin may build up in the blood, causing jaundice (yellowing of the skin and whites of the eyes).

Metabolism

The liver carries out many metabolic functions, providing the body with the energy it needs. It regulates the production, storage, and release of sugar, fats, and cholesterol. When food is eaten, the liver converts glucose (blood sugar) into glycogen, which is stored for later use. When energy is needed, the liver converts glycogen back into glucose in a process called gluconeogenesis. The liver regulates the storage of fats by converting amino acids from digested food into fatty acids such as triglycerides; when the body does not have enough sugar, the liver converts fatty acids into ketones, which can be used for fuel. The liver also controls the production, metabolism, and excretion of cholesterol, which is an important component of cell membranes and certain hormones.

Storage

The liver stores several nutrients, including vitamins A, D, B-9 (folate), and B12. It also stores iron and plays a role in converting iron into heme, a component of hemoglobin (the oxygen-carrying molecule in red blood cells).

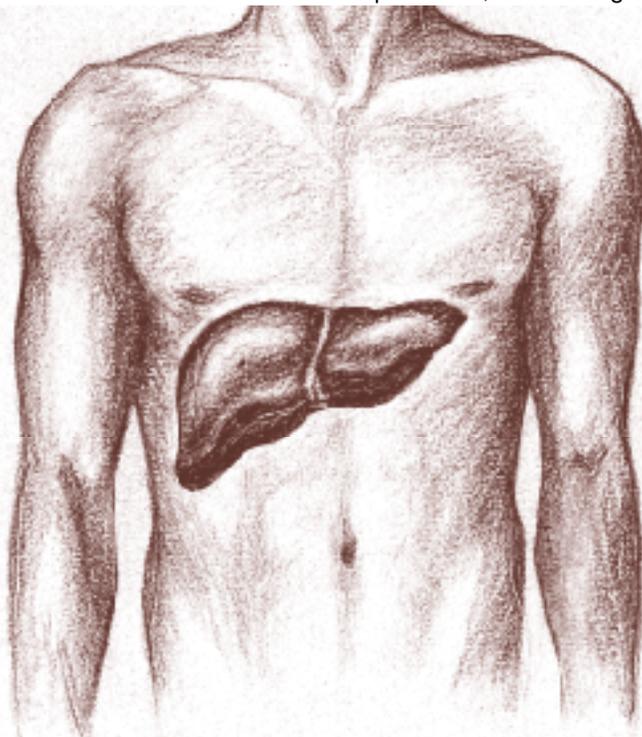
Protein synthesis

The liver synthesizes (builds) several important proteins, including enzymes, hormones,

clotting factors, and immune factors. Liver enzymes called aminotransferases or transaminases (ALT and AST) break down amino acids from digested food and rebuild them into new proteins needed by the body. When liver cells are inflamed or damaged, these enzymes can leak out and build up to high levels in the blood; these enzymes can be measured using a simple blood test.

Several of the proteins

synthesized by the liver are needed for proper blood functioning. These include various binding proteins (which bind and transport substances such as vitamins, minerals, hormones, and fats) and albumin (a protein that helps maintain proper blood volume). Clotting factors produced by the liver include fibrinogen, prothrombin (Factor II), and a protein in the coagulation cascade process (Factor VII). These enable the blood to clot following an injury; low levels can lead to prolonged bleeding and easy bruising. Other proteins synthesized by the liver include alkaline phosphatase, gamma-glutamyl transferase (GGT), and insulin growth factor (IGF-1).



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Detoxification

The liver plays a crucial role in detoxifying substances that are harmful to the body, including alcohol, drugs, solvents, pesticides, and heavy metals. When a person is exposed to high levels of these chemicals, the liver can become overwhelmed. Toxins are delivered to the liver by the portal vein. The liver processes these chemicals and excretes them in the bile. The liver also processes and excretes toxic by-products of normal metabolism (such as ammonia) and excess hormones (in particular, sex hormones such as estrogen). Many drugs—including common over-the-counter drugs such as acetaminophen (Tylenol), most anti-HIV drugs, and certain herbal remedies—are processed by the liver and can cause liver damage. People should be especially cautious about combining alcohol, multiple drugs and herbs. If the liver is damaged it may not be able to break down and excrete drugs efficiently, which could potentially lead to dangerously high blood levels and intensified side effects.

Liver Damage

Chronic hepatitis C or B, heavy alcohol use, and other factors can lead to serious liver damage. Given how many vital functions the liver performs, it is not surprising that liver injury can have an effect on almost all body systems, including the digestive, endocrine, cardiovascular, and immune systems. As the liver sustains damage, normal liver tissue becomes fibrous (fibrosis – light scarring), fatty (steatosis), and extensively scarred (cirrhosis). If the liver becomes too heavily damaged, it is no longer able to carry out its normal functions.

In compensated cirrhosis, the liver is scarred but can still function relatively normally. In decompensated cirrhosis, the liver has sustained so much damage that it is unable to function properly. Scar tissue may block the normal flow of blood through the liver, causing blood to back up. This can lead to portal

hypertension (high blood pressure), the development of varices (stretched and weakened blood vessels) in the esophagus, stomach and other organs of the gastrointestinal system, and internal bleeding. People with severe liver damage (decompensated cirrhosis) may also develop ascites (fluid accumulation in the abdomen), edema (swelling, especially in the legs and ankles), and kidney (renal) damage. If the liver is unable to filter out toxins and metabolic by-products such as ammonia, these chemicals may build up in the blood, leading to impaired brain and mental functioning, personality changes (encephalopathy), and (in severe cases) coma and death. People with long-term liver damage may also develop liver cancer.

Acetaminophen

The pain-reliever acetaminophen (brand name Tylenol)-also known as paracetamol (APAP)—is one of the best-selling over-the-counter medications, used by more than 200 million Americans a year. It is an ingredient in nearly 600 medications, both over-the-counter and prescription medications.

Most people believe that acetaminophen is safe, but it can cause serious liver damage-and even acute liver failure-if it is taken in high enough doses. In fact, it is one of the leading causes of liver failure in the United States, accounting for more than 56,000 emergency room visits, 2,600 hospitalizations and an estimated 450 deaths per year.

Important facts to remember about Acetaminophen:

- Never mix acetaminophen with alcohol
- Talk with your doctor about the right amount or dose of acetaminophen to take for healthy people and those with hepatitis C
- Check the label of the medications to find out if it contains acetaminophen—factor that amount of acetaminophen into any other amount to make

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sure you are not exceeding the safe limit

- Do not take acetaminophen for more than 10 days

Non-Steroidal Anti-inflammatory Drugs (NSAIDs)

NSAIDs (aspirin, ibuprofen and naproxen) are common medicines taken for pain and to reduce inflammation. It is safe for most people if taken as directed, but for some people NSAIDs can cause serious complications. It is estimated that there are 16,500 deaths a year from NSAIDs. NSAIDs can cause a variety of problems including bleeding issues for people with hepatitis C and others with certain conditions. Always check-in with a medical provider before taking an NSAID.

Alcohol

The liver is responsible for converting alcohol into a substance that is safe for the body. Of note, there may be a very small amount of alcohol that does not reach the liver—this is excreted in the urine and breath. That’s why breath analyzers are able to measure the amount of alcohol a person drinks.

There are certain liver enzymes that are responsible for converting alcohol into safe substances: *alcohol dehydrogenase (ADH)*, *aldehyde dehydrogenase (ALDH)* and *cytochrome P450IIE1(CYP2E1)*. ADH is the main enzyme responsible for converting alcohol. In people who are chronic alcohol drinkers the liver will make more CYP2E1 in an effort to compensate for excess alcohol intake. Unfortunately, the extra production of CYP2E1 does not do much to stabilize the effects of long-term abuse that damages the liver.

The recommended alcohol use for consumption for healthy people is two alcoholic drinks a day for men, one alcohol a day for women. People with hepatitis C should avoid alcohol.

Keeping the Liver Healthy

Listed below are some steps to take to help maintain liver health.

Healthy Liver Tips:

- Eat a healthy, well-balanced diet that follows the general guidelines for good nutrition at www.choosemyplate.gov; such a diet is low in fat and sodium, high in complex carbohydrates, and has adequate protein.
- If you have liver disease, avoid or reduce the consumption of alcohol.
- Avoid or limit the use of recreational drugs.
- Take no more than the recommended doses of medications.
- Take no more than the amount of acetaminophen (brand name Tylenol)/paracetamol recommended by your medical provider and never mix it with alcohol. It is important to note that acetaminophen/paracetamol is an ingredient in over 600 over-the-counter and prescription medications.
- People with any form of liver disease should talk with their medical provider about the dose of acetaminophen that is safe to take for them.
- Use caution when mixing over the counter medications, prescription drugs, herbs, street drugs, and alcohol.
- Avoid exposure to toxic liquids and fumes including solvents, paint thinners, and pesticides. If it is necessary to use such chemicals, work in a well-ventilated area, cover the skin, and wear gloves and a protective facial mask.
- Avoid raw or undercooked shellfish, which may contain bacteria or viruses.
- Get vaccinated against hepatitis A and hepatitis B if not already immune.
- Avoid or reduce stress—it is unhealthy for the body and for the liver.

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Standard drink equivalents

	Beer or cooler 12 oz., ~5% alcohol	12 oz. = 1 16 oz. = 1.3 22 oz. = 2 40 oz. = 3.3
	Malt liquor 8-9 oz., ~7% alcohol	12 oz. = 1.5 16 oz. = 2 22 oz. = 2.5 40 oz. = 4.5
	Table wine 5 oz., ~12% alcohol	a 750 mL (25 oz.) bottle = 5
	80-proof spirits (hard liquor), 1.5 oz., ~40% alcohol	a mixed drink = 1 or more* a pint (16 oz.) = 11 a fifth (25 oz.) = 17 1.75 L (59 oz.) = 39

* Depending on factors such as the type of spirits and the recipe, one mixed drink can contain from one to three or more standard drinks.
 Source: NIAAA

Portions of this text were taken from *An Introduction to the Liver*, by Liz Highleyman.

Related Publications

- **An Overview of HCV Diagnostic Tests**
www.hcvadvocate.org/hepatitis/factsheets_pdf/diagnostic.pdf
- **An Overview of HCV Disease Progression**
www.hcvadvocate.org/hepatitis/factsheets_pdf/Disprogress_over.pdf
- **An Overview of HCV Transmission and Prevention**
www.hcvadvocate.org/hepatitis/factsheets_pdf/Transm_preven.pdf

For more information

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| <ul style="list-style-type: none"> • Medline Plus
 www.nlm.nih.gov/medlineplus/liverdiseases.html • American Cancer Society
 www.cancer.org/Cancer/LiverCancer/ • Mayo Clinic
 http://www.mayoclinic.org/ | <ul style="list-style-type: none"> • National Digestive Diseases Information Clearinghouse (NDDIC)
 http://digestive.niddk.nih.gov/ddiseases/pubs/cirrhosis/ • The Medicine Cabinet
 http://www.medicinenet.com/liver_disease/article.htm |
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