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Nutrition And The Liver

What is the liver and what does it do?

Situated beneath the diaphragm in the upper right part of the abdomen, the liver is the largest organ in the body (weighing 1-1.5 kg in adults). All of the blood that leaves the stomach and intestines must pass through the liver before reaching the rest of the body. The liver processes nutrients and drugs absorbed from the digestive tract into forms that are easier for the rest of the body to use. In essence, the liver is the body's refinery.

Furthermore, your liver plays a principal role in removing toxins from the blood whether they were ingested or internally produced. The liver converts them to substances that can be easily eliminated from the body.

The liver also chemically modifies many drugs taken to treat diseases. These changes govern the drug's activity in the body.

The liver also makes bile, a green-yellow fluid, which contains detergent-like substances essential for digestion. Bile is stored in the gall bladder, which contracts after eating and discharges bile into the intestine.

How are nutrition and the liver interrelated?

Nutrition and the liver are interrelated in many ways. Some ways are well understood; others are not. Your liver plays a key role in converting food into the chemicals essential for life. The liver serves several important metabolic tasks in handling nutrients (see table).

Carbohydrates (sugars), absorbed through the lining of the intestine, are transported through blood vessels to the liver and then converted into glycogen and stored. The liver breaks down this stored glycogen between meals, releasing sugar into the blood for quick energy to prevent low blood sugar levels (hypoglycemia). This enables us to keep an even level of energy throughout the day. Without this balance we would need to eat constantly to keep up our energy.

The liver is vital in maintaining the body's protein and nitrogen metabolism. Proteins in foods can be broken down into amino acids in the intestine and delivered to the liver for use in making body proteins. Excess amino acids are either released by the liver and sent to the muscles for use or are converted to urea for excretion in the urine. Certain proteins are converted into ammonia, a toxic metabolic product, by bacteria in the intestine or during the breakdown of body protein. The ammonia must be detoxified by the liver and made into urea, which is then excreted by the kidneys.

Through the production of bile, the liver makes it possible for dietary fat to be absorbed. In addition, vitamins A, D, E and K, which are fat soluble, are dependent on bile from the liver for absorption.

Metabolic Work of the Liver[1] Here are some of the things the liver does with nutrients			
Carbohydrates	Lipids	Proteins	Other
Converts carbohydrates to glucose	Builds and breaks down triglycerides, phospholipids, and cholesterol as needed	Makes nonessential amino acids that are in short supply	Detoxifies alcohol, other drugs, wastes and poisons
Makes and stores glycogen	Breaks down fatty acids for energy when needed	Removes from circulation amino acids that are in excess and converts them to other amino acids	Helps dismantle old red blood cells and captures iron for recycling
Breaks down glycogen and releases glucose	Packages extra lipids and transports them to other body organs	Removes ammonia from the blood and converts it to urea to be sent to the kidneys for excretion	Stores some vitamins and minerals
Breaks down glucose for energy when needed	Makes bile to send to the gallbladder for use in fat digestion	Makes other nitrogen-containing compounds the body needs (e.g. DNA & RNA)	Forms lymph
Makes glucose from amino acids and glycerol when needed	Makes ketone bodies when necessary	Makes plasma proteins such as clotting factors	

How does liver disease affect nutrition?

Many chronic liver diseases are associated with malnutrition. Patients with advanced cirrhosis are often malnourished, with wasting of the muscle mass and an emaciated appearance. People who are well nourished, but drink alcohol, are also susceptible to alcoholic liver disease. It is known that a dramatic loss of weight (35-40%) can be associated with liver disease of any type.

Why should people with liver disease maintain a well-balanced diet?

It is vitally important that patients with liver disease maintain a balanced diet, one that ensures adequate intake of carbohydrates, fats and proteins. Such a diet will reduce the risks associated with malnutrition and help prevent muscle loss.

Protein restrictions are rarely indicated since there are no major benefits of limiting protein intake and a low-protein diet has not been shown to improve liver function or reduce ammonia levels. In fact, a low-protein diet hastens muscle breakdown[2]. Protein requirements should be assessed on an individual basis and adjusted according to tolerance and illness severity.

Patients with the end-stage liver disease should be referred to a nutritionist or dietitian for counseling.

When are specific diet restrictions required?

Beyond the maintenance of a good, well-balanced diet, several liver conditions require specific dietary management.

Hepatic Encephalopathy (HE)

Hepatic encephalopathy is a condition of impaired mental function due to altered liver function. It is often seen when severe scar tissue formation (cirrhosis) in the liver prevents the normal flow of blood through the liver. The blood, which contains toxins, is "shunted", or redirected, back to the central circulation and into the brain without first going through the liver for detoxification.

Cirrhosis with portal hypertension (an elevation of the portal pressure due to the obstruction of blood flow through the liver) may be treated surgically by shunting some of the blood around the liver, connecting the portal system with the systemic circulation. This "shunted" blood contains high concentrations of amino acids and ammonia and probably other, as yet unidentified, toxic substances that may cause altered mental function in some patients.

The treatment for hepatic encephalopathy is aimed at reducing toxins like ammonia, which is a by-product of protein digestion. Only a very few patients with disabling encephalopathy who have not responded to lactulose or neomycin therapy, which helps rid the body of ammonia, may have protein intolerance and require a lower protein dose. Hepatic encephalopathy is precipitated by increased dietary protein in only 7 to 9% of patients with liver failure.

Note: Not all patients with end-stage liver disease experience encephalopathy and not all patients with HE require protein restriction[3,4]. Severe protein restriction (20 grams a day or less) is impractical for long-term therapy and is not recommended.

Along with dosage, type of protein should also be considered in patients with protein sensitivity. The data prove that consuming mainly vegetable protein vs. protein of animal origin is worthwhile under optimum lactulose therapy[5]. Adequate protein intake can help restore depleted protein stores and slow muscle loss. Such proteins are found in dried beans, peas, chickpeas, lentils, and soybeans. Canned beans are high in salt so are generally not recommended. It's also worth mentioning that vegetable based diets provide additional fiber, which improves bowel regularity and can help rid the body of toxins.

Proteins are comprised of several types of amino acids. A special group of amino acids are called the branched-chain amino acids (BCAAs). Patients with liver diseases that lead to coma have lower concentrations of BCAAs and higher levels of other amino acids. Some research suggests that patients in a hepatic coma might improve by providing BCAA-enriched formulas.

Where are BCAAs found?
Dairy products and red meat contain the greatest amounts of BCAAs, although they are present in all protein-containing foods. Whey protein and egg protein also contain BCAAs.

Note: Any treatment of people with liver failure requires the direction of a physician.

Ascites and Edema

Ascites is the accumulation of fluid in the abdominal cavity. Edema is fluid built up in the tissues, usually the feet, legs or back. Both conditions result from abnormal accumulation of sodium associated with portal hypertension and liver disease. Usually only "no added salt" is recommended for patients with cirrhosis. However, sodium intake is often restricted for patients who develop decompensated cirrhosis with ascites. Such a diet would allow only 2-3 grams of sodium and would exclude canned meats, soups and vegetables, cold cut meats, condiments such as mayonnaise and ketchup, and some cheeses. Most fresh foods are low in sodium. The best salt substitute is lemon juice (which is salt free).

Cholestasis

Cholestasis is an inability of the liver to excrete bile. This may result in steatorrhea (fat malabsorption due to inadequate amounts of bile). Steatorrhea may go unnoticed by the patient or can be associated with weight loss due to lost fat calories. Stools may be oily in appearance and foul smelling. Fat supplements are available; the most commonly used being medium-chain triglycerides (MCT oil). Safflower oil can also be used. These oils are more readily absorbed since they are not as dependent upon bile for their digestion. They are often used as a caloric supplement. MCT oil is used like any other cooking oil, in salad dressings or in cooking. Patients with steatorrhea may also have difficulty absorbing fat-soluble vitamins (A, D, E, and K). However, water-soluble vitamins are absorbed normally. Supplementing the diet with fat-soluble vitamins is possible, though it should only be carried out under the guidance of a physician.

Wilson Disease

In Wilson disease there is a defect in copper metabolism. Patients affected by this disorder have an abnormal build-up of copper in the body due to the inability of the liver to excrete it. This inability allows the copper to accumulate in several organs: first the liver, and then usually the brain and the cornea of the eye. Treatment involves the use of a de-coppering agent, penicillamine, which removes the excess copper from the body. Dietary therapy for this disease includes the avoidance of copper-containing foods like chocolate, nuts, shellfish and mushrooms.

Hemochromatosis

Hemochromatosis is a disease in which there is an inappropriate absorption of iron from the intestine. The excessive iron then accumulates in the liver, pancreas, and other organs in the body. Patients with this disease should not be given iron supplements. Aside from this precaution, those with hemochromatosis may follow a normal diet. Treatment is achieved by frequent removal of blood from a large vein.

Fatty Liver

The most common cause of fatty liver disease in Canada is obesity. Other causes of fatty liver disease include starvation and rapid weight loss, diabetes, insulin resistance and high blood pressure, alcohol, some drugs and chemicals, and genetic factors. The treatment of fatty liver disease is related to the cause. Patients who are overweight are advised to achieve a gradual and sustained weight loss through a well-balanced diet that is low in saturated fats and high in fibre. Regular exercise is an important component of any weight-loss regimen.

Gallstones

It is believed that avoiding high fat and cholesterol foods and preventing obesity can reduce the risk of gall bladder disorders. The gall bladder is a storage sac for the bile produced by the liver. During digestion, the gall bladder releases bile into the small intestine through the common bile duct. Gallstones cause most gall bladder problems and 80-90% of all gallstones are produced from excessive cholesterol, which crystallizes into small stones. Maintaining a well-balanced diet and avoiding high cholesterol intake may lower the incidence of gallstone formation.

The Committee on Diet and Health makes the following recommendations for decreasing the risk of gallstones:

- Reduce total fat intake to 30% of energy intake
- Reduce saturated fat intake to less than 10% of energy intake
- Reduce cholesterol intake to less than 300 mg daily (note: one large egg contains approximately 212 mg cholesterol).

Are supplements and salt substitutes necessary?

Patients with liver disease should be wary of diet supplements and fad foods or packaged "nutritional" aids. Such foods can contain a lot of salt, potassium or inappropriate protein mixtures. Those that are safe should be taken only under a physician's guidance.

References

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