



**Veterinary Emergency
+ Referral Center**
of Hawaii

**Ettinger: Textbook of
Veterinary Internal Medicine, 7th Edition
Liver Failure and Hepatic Encephalopathy Management**
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What causes liver disease?

The liver is responsible for many important functions including the removal of by-products from the digestion of food, absorption of food, production of proteins necessary for normal blood consistency, and clotting as well as production of other key molecules involved in metabolism. Different liver disease processes can lead to progressive damage and destruction of liver cells and can lead ultimately to *liver failure*. The initial damage usually results in leakage of certain enzymes from the liver cells into the bloodstream. Increased concentrations of these liver enzymes on a blood test indicate that a dog or cat may have a hepatopathy (liver disease) but does not indicate whether the animal has liver failure. Measuring substances made by the liver such as blood glucose, cholesterol, bilirubin, and albumin provides insight into liver function. When the liver fails, decreases in some or all of these substances can be observed in the blood. Special tests, such as a bile acid test, used to further document liver dysfunction. Once a diagnosis of liver disease is made, dietary therapy may prove beneficial in preventing further damage and in ameliorating the consequences of liver failure.

When Special Diets Might Be Beneficial Liver Disease

Abnormalities in liver enzyme concentrations alone do not usually warrant a dietary change. In some instances, if liver enzymes are consistently abnormal, the pet may benefit from supplemental antioxidants. Liver cells may be partially protected from further damage when additional antioxidant precursors or antioxidants beyond those found in the diet are given. Some veterinary nutritionists and veterinarians recommend supplementation with vitamin E, vitamin C, S-adenosyl-methionine (SAME), and/or silymarin (Milk Thistle). However, the exact mechanism of action, dosing, and efficacy of these supplements are still under investigation.

The branched-chain amino acids (BCAA), leucine, isoleucine, and valine, have also been suggested as beneficial supplements for humans. Low blood concentrations of BCAA can occur in liver disease, but it is unclear whether supplementation is justifiable given their high cost and the lack of conclusive evidence that they are beneficial. Protein restriction is NOT recommended in every animal that has liver disease based on evidence from research in humans. The protein requirement may be increased and unnecessary restriction can reduce the production of important proteins such as albumin. Reduced albumin concentrations put the animal at risk for abnormal fluid accumulations, such as ascites (abdominal fluid). However, protein restriction can be crucial in treating the small number of animals with clinical signs of protein intolerance (hepatic encephalopathy or HE; see section below) but may be detrimental in patients without signs of HE.

Copper Storage Diseases

Some dogs store increased concentrations of copper in their liver because of a genetic abnormality or secondarily because of another underlying liver disease. Increased concentrations of copper can potentiate oxidative stress and result in further liver damage. To minimize this damaging accumulation, dietary copper is often restricted. In addition, dietary zinc may be recommended because higher concentrations can reduce the uptake of copper from the gut. The effectiveness of decreasing copper and

increasing zinc is difficult to monitor because it requires serial liver biopsies. It is unknown if the copper that accumulates in the liver is available for use by the body. Thus many veterinarians monitor a pet's blood count to ensure that they are not developing an anemia as a result of excessive copper restriction.

Liver Failure

Dogs and cats diagnosed with liver failure may benefit from dietary treatment as described above for liver disease. Typically, no additional nutritional recommendations are made unless the pet is suffering from urate urolithiasis (please request hand out entitled "Urolith Management") or from hepatic encephalopathy (see section below).

Hepatic Encephalopathy

Some animals with liver failure lose the ability to remove toxins (normal by-products from digested and absorbed food) from the circulation. Therefore these by-products remain in the circulation and lead to metabolic and clinical abnormalities. These adverse effects are frequently manifested as neurologic signs, referred to as *hepatic encephalopathy* (HE). Symptoms of HE can include lethargy or your pet acting "spacey" or "star gazing", and it can cause seizures. The onset of these clinical signs is frequently associated with the consumption of a meal. Foods high in protein are frequently associated with the development of clinical signs because one of the breakdown products of protein is ammonia. Ammonia is hypothesized to be one of the key triggers of HE. Along with diet, certain medications can also reduce the side effects of excess circulating ammonia.

The source of dietary protein can significantly influence the manifestation and severity of HE. Based on research and clinical experience, meat-based protein can trigger a more severe response compared with vegetable and dairy proteins. Therefore cottage cheese or egg-based diets are commonly utilized, as are vegetarian diets for dogs with HE. Cats have too many special nutritional needs as carnivores to be able to do well on a vegetarian diet.

Another approach is to decrease the amount of protein in the diet since many of the HE triggers are found in or are associated with protein. This strategy can be effective, but can also lead to protein malnutrition if the animal is not eating enough food to meet its daily energy needs. Most pets with clinical signs of HE have a liver that is not efficient at using dietary protein and thus may actually need more protein and not less. This is why protein is not restricted in pets with liver disease unless they have clinical signs of HE. Even when pets have signs of HE, many veterinarians will slowly increase the amount of protein in the diet (for example, by adding small amounts of cottage cheese) in an attempt to maximize the amount of protein the pet is consuming without causing signs of HE. Monitoring blood albumin concentration, along with a physical exam and information regarding your animal's food intake, can assist your veterinarian in determining if your animal suffers from or is prone to protein malnutrition.

Progression

Unfortunately, like many diseases, liver disease can progress and become worse. Thus dogs and cats that initially did not require protein restriction may later benefit from restriction. Caution should be taken to prevent premature restriction as discussed above. Likewise, pets with HE may require further restriction as their disease progresses. Therefore no one diet plan works for every animal, nor does one diet work at every point in the disease. Careful monitoring of your pet can aid your veterinarian in selecting the best diet for your pet at any given point in the disease process.