

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

DIET AND NUTRITION FOR **LIVER DISEASE AND** **HEPATITIS**

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Questions frequently asked by liver diseased patient concerning diet and nutrition

- What foods are good for the liver?
- Are there foods that can harm the liver?
- Are vitamin supplements helpful?
- How much protein should I get in my diet?

IS THERE AN OPTIMAL DIET FOR THOSE WITH LIVER DISEASE?

- Many factors account for the unfeasibility of a standardized liver diet.
- Variations among the different types of liver disease (for example, alcoholic liver disease versus primary biliary cirrhosis)
- Stage of the liver disease (for example, stable liver disease without much damage versus unstable decompensated cirrhosis).
- Other medical disorders even if unrelated to their liver disease, such as diabetes or heart disease, must also be factored into any diet.

- Each person has her own individual nutritional requirements, and these requirements may change over time.
- Most people with liver disease find that eating multiple small meals throughout the day is the best approach, as it maximizes energy levels and the ability to digest and absorb food.
- However, if one insists on eating three meals per day try to follow the saying

“ eat breakfast like a king, lunch like prince and dinner like a pauper”.

- Patients with advanced liver disease should be recommended a diet providing adequate calories, proteins, minerals and vitamins.
- Dietary supplementation is much essential in CLD, which can decrease malnutrition, infections and sepsis happened.

DIET IN ACUTE LIVER DISEASE

- 1. Acute Hepatitis
- 2. Fulminant Hepatitis
- 3. Acute Cholestasis

1. Acute Hepatitis

- Patients with acute hepatitis are usually adequately nourished before the illness.
- Acute hepatitis is usually a mild disease, associated with only a few days of anorexia, nausea, and occasionally vomiting.
- These are usually well tolerated by the patients, who require no nutritional supplementation, and are encouraged to eat normally.
- Usually they can take some food by mouth and enough fluids to prevent dehydration.

- Old literature emphasized lipid restriction. This, however, is not true, and lipid restriction has no role in acute hepatitis unless fats aggravate nausea in an individual patient.
- Dietary restrictions have no place in the management of mild or moderate acute parenchymal liver disease.
- Nutritional supplementation and iv fluids and nutrients are reserved for the patients with excessive nausea and vomiting who cannot maintain a sufficient fluid balance.
- Alcohol should be avoided in acute hepatitis and for the 6 months following recovery

2. Fulminant Hepatitis

- In FHF, hypoglycemia is a major threat, and may be severe.
- Patients may become malnourished rapidly due to the hypercatabolic state
- These patients require a continuous parenteral glucose infusion as 10-25% glucose, providing 150-200 gm glucose/day, with repeated monitoring of blood glucose.
- They should, in addition, receive nutritional support to suppress protein hypercatabolism and help liver regeneration.
- The infusion of amino acid / glucose mixtures supplying 3 g amino acids and 5 g glucose per hour

3. Acute Cholestasis

- Patients with acute biliary obstruction require immediate surgical or endoscopic relief.
- There is no need for nutritional supplementation except for **parenteral vitamin K** to correct the prothrombin time prior to the procedure (unless there are pre-existing disorders that compromised the nutritional status).

DIET IN CHRONIC LIVER DISEASE

- 1. Nutritional Abnormalities in Chronic Liver Disease
 - a. Malnutrition
 - b. Metabolic Basis of Malnutrition
- 2. Dietary Management
 - a. Energy Requirements
 - b. Lipids
 - c. Proteins
 - d. Diet Composition
 - g. Branched Chain Amino Acids (BCAA)
- 3. Decompensated Liver Disease
 - a. Encephalopathy
 - b. Ascites

Normal healthy liver, surface is smooth and uniform



Sever cirrhosis, surface is very nodular



www.gihealth.com/newsletter/34/two_livers.jpg

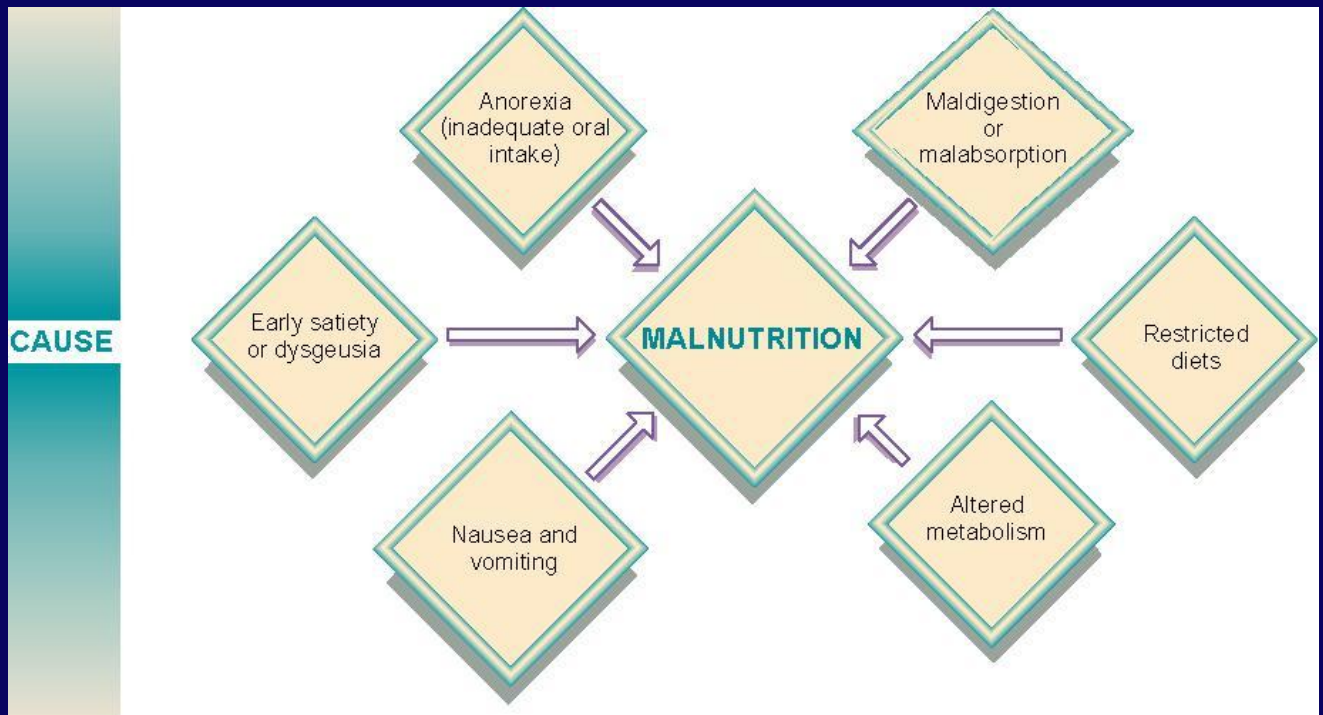
Severe Malnutrition and Ascites



Causes of malnutrition

- _ Anorexia and early satiety
- _ Nausea and vomiting
- _ Steatorrhea and malabsorption
- _ Medication-induced losses
- _ Alterations in energy and protein metabolism
- _ Restricted diets
- _ Paracentesis induced PT loss
- _ Complications

Malnutrition in Liver Disease—Cause



Algorithm content developed by John Anderson, PhD, and Sanford C. Garner, PhD, 2000. Updated by Jeanette M. Hasse and Laura E. Matarese, 2002.

- Malnutrition is an early and typical aspect of hepatic cirrhosis.
 - 20 % of those with mild liver disease
 - 70% of p't with cirrhosis have signs of PT/Cal malnutrition.
 - 100 % of people at time of transplant.
-
- Hidden by fluid gains from edema & ascites
 - Signs: - muscle wasting
 - - decreased fat stores.

Malnutrition

- ↑ Mortality (35% v.s. 16% in normal-fed p't) .
- ↑ Complications : ascites (44% v.s. 24%)

a. Energy Requirements

- Patients with chronic liver disease should be encouraged to maintain adequate energy consumption.
- Patients usually need 35-45 kcal/kg/day.
- Excess calories should be avoided, particularly as carbohydrates, as this promotes hepatic lipogenesis, liver dysfunction, and increase CO₂ production and the work of breathing.

a. Energy Requirements. Cont..

- Carbohydrates should be sufficient to maintain normal blood glucose levels, and should **not exceed insulin reserves**. They should supply 60-70% of non nitrogen calories.

a. Energy Requirements. Cont..

- Cirrhosis is a disease of **accelerated starvation**, so patients should avoid long time without feeding.
- Patients often do better on multiple small meals with a **late bed-time meal**, which has been shown to reduce the need for gluconeogenesis and conserve proteins and nitrogen balance after an overnight fast, and prevent protein breakdown.

b. Lipids

- Around 30% of total calorie intake should be supplied as fat, People who are overweight should aim for 10 % .
- Lipid emulsions depend little on the liver for metabolism, are well tolerated in patients with cirrhosis.
- A mixed fuel system improves nitrogen balance compared to glucose alone. Even in decompensated cirrhosis, high lipid containing parenteral mixtures were found to be well tolerated and improve encephalopathy.

b. Lipids cont..

- Thus lipid restriction has **no scientific** basis in patients with cirrhosis.
- Fat should be provided as polyunsaturated fatty acids, with less than 50% long chain triglycerides.
- Fat helps make food **tastier**. This is important for people who suffer from a suppressed appetite due to chronic liver disease.

b. Lipids cont..

- People need some fat in order to properly absorb the four fat-soluble **vitamins**—**A, D, E, and K**. Without some fat, these vitamins may become deficient in the body, even if they are taken in supplemental form.
- This type of vitamin deficiency sometimes occurs in people with cholestatic diseases, such as primary biliary cirrhosis.

c. Proteins.

- Proteins should not be restricted in patients with liver disease unless they become protein intolerant due to encephalopath .
- Protein intake should be in the range of 1-1.5 g/kg/day.

c. Proteins. Cont.

- Several studies have shown that a daily protein supply of 1.0-1.2g/kg/day may be sufficient to prevent negative N₂ balance in cirrhosis .
- With mild stress, this has to increase to 1.5 g/kg/day, and with acute exacerbations of hepatitis or decompensation to 2.0 g/kg/day.

c. Proteins. Cont.

- Special attention should be paid to patients on beta-blockers for prevention of variceal bleeding.
- Beta-blockers increase protein oxidation (an alternative method of protein metabolism without energy production), and may increase protein requirement .
- patients on propranolol should be placed on the higher end of the protein intake.

Amino Acids Commonly Altered in Liver Disease

- Aromatic amino acids—serum levels increased
 - Tyrosine
 - Phenylalanine*
 - Free tryptophan*
- Branched-chain amino acids—serum levels decreased
 - Valine*
 - Leucine*
 - Isoleucine*
- Other amino acids—serum levels increased
 - Methionine*
 - Glutamine
 - Asparagine
 - Histidine*

* Denotes essential amino acids

Oral BCAAs in cirrhosis with or without chronic encephalopathy

- Oral BCAAs are generally used in athletes
- BCAAs supplementation can only be recommended in p't at high risk of encephalopathy
- BCAA-enriched formulations can be useful in p't who are intolerant to PT and malnourished, which can improve PT synthesis and reduce post injury catabolism.

Oral BCAAs in cirrhosis with or without chronic encephalopathy cont..

- BCAA-enriched soln. increased serum alb. also reduced morbidity and improved the quality of life.
- BCAA have an **anticatabolic** effect in patients with chronic liver disease because of their ability to serve as an energy substrate for muscles.

Nishitani et al, 2004

Oral BCAAs in cirrhosis with or without chronic encephalopathy cont..

- It was found that **muscle catabolism** significantly decreased over 3 days following daily infusion of 40 g of BCAA enriched mixtures .
- Leucine is the most active in promoting protein synthesis and inhibiting protein breakdown.
- Isoleucine and valine increase nitrogen balance and increase tissue concentration of leucine.

BCAA supplementation, a possible insulin-sensitizing agent

- Recently, BCAA-enriched supplementation reduces insulin resistance in patients with HCV infection.
- In a multicenter, randomized, controlled trial, BCAA supplementation led to a reduction in the risk of HCC in cirrhotic patients .
- This suppressive effect on hepatocarcinogenesis was more evident in obese patients with HCV infection.

Kawaguchi [*World J Gastroenterol* 2010 April 28]

I.V. BCAAs in cirrhosis with acute encephalopathy

- Certainly BCAAs don't worsen encephalopathy and may be safely used to maintain an adequate PT intake in subjects at risk of altered mental state.
- BCAAs may be easily used as energy sources, thus improving nitrogen balance and have a beneficial on anorexia.
- No statistically evidence that BCAA had a significant beneficial effect on survival in patients with HE

Vitamins And Liver Disease and Hepatitis

- Vitamins They are essential to human development, growth, and functioning. Normally, the required amount is supplied by eating a well-rounded diet.
- Vitamins must pass through the liver to be metabolized. If taken to **excess**, any vitamin has the potential to cause serious health problems.
- The damage is much greater, depending upon the severity of liver damage.

Vitamin/Mineral Deficits in Severe Hepatic Failure

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K
- Vitamin B₆
- Vitamin B₁₂
- Folate
- Niacin
- Thiamin
- Zinc
- Magnesium
- Iron
- Potassium
- Phosphorus

Calcium (Ca)

- Patients with chronic liver disease are at increased risk for the development of osteoporosis, it is important to consume foods rich in calcium and/or to supplement their diets with calcium .

Sodium (Na)

- The body requires only about 50 to 400 mg of sodium per day. Yet, the average diet consumes about twenty -five -to- thirty -five times that amount!
- While this over- consumption of salt is not dangerous for most healthy individuals, it can create problems for advanced liver disease.

Iron (Fe)

- The amount of iron in the body is about 3-4 grams, (50mg per kg in men and 40 mg per kg in women).
- The body has a limited ability to eliminate excess iron from the body.
- Only about 1-2 mg of iron is capable of being excreted each day.
- Excess iron is ingestion (whether in the form of food or supplements), is stored in body tissues, primarily the liver. that is most susceptible to iron toxicity of.

Iron (Fe) cont..

- There are two types of dietary iron.
- **Heme, or animal iron** (i.e. red meat), is well absorbed from the diet.
- **Nonheme, or plant iron** (i.e. spinach), is poorly absorbed into the body (spinach is not a good source of iron).
- **Only** about 15 % of ingested animal iron, and only 3 % of ingested plant iron.

Iron (Fe) cont..

- **IRON CONTENT OF SOME COMMON FOODS**

Food	Portion	Iron [mg]
<hr/>		
• Beef	3.0 oz.	6.1
• Liver	3.5 oz.	14.2
• Chicken	3.5 oz	1.1
• Shrimp	3.0 oz	2.5
• Iron fortified cereals	1.0 oz	4.5
• Spinach	1 cup	0.8

Iron Over Load

- Patients with chronic hepatitis C have abnormal iron studies(In different series, 22-62% of patients have elevated serum ferritin values
- Recent studies showed that iron-regulating molecules are modulated by HCV infection. Hepcidin is a negative regulator of duodenal iron absorption and macrophage iron release and decreased hepatic expression of hepcidin is seen in patients with HCV infection.
- In addition, upregulation of hepatic expression of transferrin receptor 2, a mediator of iron uptake, is responsible for hepatic iron overload.

Lecube et al, 2007

Iron Over Loadcont

- Hepatic iron overload produces oxidative stress and is a factor responsible for the development of HCV-associated insulin resistance.
- There is a clear association between elevated iron indices and increased liver damage from HCV. Elevated iron indices have repeatedly been associated with increases serum transaminases .

Kawaguchi [*World J Gastroenterol* 2010 April

Zinc

Zinc plays a crucial role in the metabolism of protein, carbohydrate, lipid, nucleic acid, and ammonia.

zinc supplementation improves glucose disposal in patients with cirrhosis.

Zinc also inhibits hepatic inflammation and hepatic fibrosis.

More recently, zinc supplementation was shown to lower the cumulative incidence of HCC in patients with HCV infection.

As the serum zinc level is decreased in patients with HCV infection supplementation of zinc could be a therapeutic option.

Kawaguchi [*World J Gastroenterol* 2010 April

Smoking

- Smoking suppresses endogenous Interferon leading to flare of HCV .
- Smoking increases iron content leading to increased cirrhosis viral flare and HCC .
- Smoking increases incidence of hepatic malignancies .
- Smoking markedly increases micro- & macro-vascular complication of DM .



Caffeine's Effect on Hepatitis/Liver Disease

- Caffeine is present in coffee, tea, chocolate, cola, and some over-the-counter medications.
- Caffeine is metabolized through the liver. However, caffeine itself is not directly harmful to the liver.
- Some people may experience a rapid heartbeat and/or palpitations from caffeine consumption.
- Excessive intake of caffeine in patients with chronic liver disease at increased risk for osteoporosis and bone fractures.

Caffeine's Effect on Hepatitis/Liver Disease cont..

- In cirrhotic patients, the metabolism of caffeine is slowed, resulting in higher concentrations of caffeine in the blood.
- In patients treated with **interferon** cause symptoms similar to those caused by caffeine.
- Recent study has suggested that caffeine may in be advantageous to people with liver disease.
- However, this result has not been substantiated by other studies .

3. Decompensated Liver Disease

- a) Encephalopathy
- b) Ascites

Historical Treatment Theories: Protein Restriction

- Studies in early 1950's showed cirrhotic pts given "nitrogenous substances" developed hepatic "precoma"
- Led to introduction of protein restriction
 - Began with 20-40g protein/day
 - Increased by 10g increments q3-5 days as tolerated with clinical recovery
 - Upper limit of 0.8-1.0 g/kg
 - Was thought sufficient to achieve positive nitrogen balance
- Lack of Valid Evidence
 - Efficacy of restriction never proven within controlled trial

Dispelling the Myth

Normal Protein Diet for Episodic Hepatic Encephalopathy

- Objective: To test safety of normal-protein diets
- Randomized, controlled trial in cirrhotic patients with HE
 - Patients subjected to protein restriction, followed by progressive increments
 - No protein first 3 days, increasing q3days until 1.2g/kg daily for last 2 days
 - Patients followed normal protein diet (1.2g/kg)
 - Both groups received equal calories

Cordoba et al. *J Hepatol* (2004)

Dispelling the Myth


- Results

- On days 2 and 14:
 - Similar protein synthesis among both groups
 - Protein breakdown higher in low-protein group

- Conclusion

- No significant differences in course of hepatic encephalopathy
- Greater protein breakdown in protein-restricted subjects

Protein and HE Considerations

- Presence of malnutrition in pts with cirrhosis and ESLD clearly established
- No valid clinical evidence supporting protein restriction in pts with acute HE
- Higher protein intake required in CHE to maintain positive nitrogen balance
- Protein intake < 40g/day contributes to malnutrition and worsening HE 
 - Increased endogenous protein breakdown NH_3
- Susceptibility to infection increases under such catabolic conditions

Diet Modification

- Patients with encephalopathy in whom precipitating factors have been excluded and managed, and who fail to respond to lactulose, will need dietary protein modification or restriction .
- Several studies have shown that vegetable protein is better tolerated in patients with chronic encephalopathy.

Diet Modification cont..

- The mechanism of **vegetable protein** is not fully clear, but may be related to the different amino acid composition, fiber content and increasing stool bulk and softness with consequent nitrogen loss, or changes in hormonal response.
- The first step should be to shift 75% of dietary protein to vegetable protein
- Vegetables are better tolerated than milk, which is better tolerated than meat.

Diet Modification cont..

- Only when lactulose, neomycin, and diet modification fail should protein be restricted.
- Patients in coma should be placed on no protein diet till recovery starts, and a short term protein deprivation can be tolerated without adverse nutritional effects.
- Severe prolonged protein restriction as a low protein diet decreases renal plasma flow and GFR, and this may impair borderline renal function in patients with decompensated cirrhosis .

Role of BCAA

- BCAA have been tried as therapy for hepatic encephalopathy based on the fact that increasing their plasma levels inhibits the brain influx of aromatic amino acids.
- Several studies have been published using intravenous or oral BCAA supplementation for the treatment of encephalopathy. They concluded that significantly better in improving liver function but the overall mortality was similar (22% vs. 19%).
- In conclusion, BCAA have no clearly proven benefit over standard therapy in hepatic encephalopathy. In the subgroup of patients with chronic hepatic encephalopathy who are protein intolerant, BCAA supplement may prevent a negative nitrogen balance, as they are better tolerated than standard proteins or standard amino acid supplements,

Role of Zinc

- Zinc levels are decreased in patients with chronic liver disease.
- The relation of zinc to encephalopathy is controversial, but a supplementation with 600 mg zinc per day improved encephalopathy.
- The role zinc plays in the pathogenesis of encephalopathy is unknown, but it may influence metabolism of neurotransmitters and their receptors, and zinc deficiency may affect nitrogen metabolism and may elevate blood ammonia level.
- This needs further studies before zinc supplementation in encephalopathy becomes indicated as standard therapy on scientific basis.

b) Ascites

➤ Na Balance in Ascites:

- NaCl contains 0.4 g Na per gram, or 18 mEq Na. The average intake of Na in an Italian diet (which is close to our diet) is around 3 g/day (equivalent to 7.5 g NaCl, or 135 mEq Na /day).
- Cirrhotic patients who accumulate ascites on a non sodium restricted diet excrete less than 15 mEq Na in urine (usually around 10); extra-renal Na loss is about 22 mEq / day (total loss 35 mEq or 0.75 g Na or 2 g NaCl).



www.murrasaca.com/Hepaticirrosis.htm

Na Restriction

- For mobilization of ascites, Na has to be restricted to less than the daily losses. If patients have high urinary Na and are able to excrete a water load, they will respond to Na restriction alone, and will lose 200-250 g fluid for every gram Na deficit.
- A no added salt regimen together with avoiding salty food will result in a diet containing 50 mEq Na daily
- Salt restricted diet could be made more palatable by seasoning with lemon juice, onion, vinegar, garlic, pepper, mustard, salt free ketchup .

Fluid Restriction

- Fluid restriction of all patients with ascites is inappropriate.
- Patients should drink, but not to excess.
- Water restriction to treat hyponatremia is indicated only if this is severe.
- Gradually developing hyponatremia in cirrhosis, though a poor prognostic sign, has no life threatening hazards
- Rapidly developing hyponatremia, and patients are usually asymptomatic regarding this point till the serum Na drops below 110 mEq/L.
- Fluid restriction to less than 1 liter daily is justified only in hyponatremic patients, and only when the serum Na drops below 120 mEq/L.

DIET AS A CAUSE OF LIVER DISEASE

- A. Protein Energy Malnutrition
- B. Obesity
- C. Aflatoxins and Hepatocellular Carcinoma
- D. Hypervitaminosis A

B. Obesity

- Obesity is associated with the development of parenchymal liver damage and the formation of gall stones. The most common histological lesion is fatty change (steatosis),
- Fibrosis is more severe with morbid and long standing obesity and with severe steatosis.
- Occasionally, obese patients may develop an inflammation that is histologically similar to alcoholic hepatitis with the formation of Mallory hyaline bodies (Non Alcoholic SteatoHepatitis NASH).

B. Obesity cont.....

- This lesion is not related to the degree of obesity, but occasionally is preceded by a short period of weight loss. This is usually a mild slowly progressive lesion, but could progress to cirrhosis.
- Steatosis is reversible, and near normal histology is observed in obese individuals who achieve and maintain substantial weight reduction to normal ranges.

C. Aflatoxins and Hepatocellular Carcinoma

- Aflatoxins are derived from the *Aspergillus flavus*, and contaminate stored grains in tropical conditions. Aflatoxin levels in food correlate with the incidence of hepatocellular carcinoma in several areas of Africa and Asia.
- They probably alter cellular immune response and may increase the carrier rate for hepatitis B.

D. Hypervitaminosis A

- Results from prolonged exposure to high doses of vitamin A, in the range of 100,000 U daily in adults. The liver manifestations include hepatomegaly, with hypertrophy of fat storing cells, fibrosis, central vein sclerosis, and cirrhosis.

DRUG NUTRIENT INTERACTION

- Most diuretics lead to loss of potassium, magnesium and zinc.
- Spironolactone retains potassium, and supplements are not needed with its use.
- Cholestyramine results in loss of vitamin A, D, E and K, by binding bile salts.
- Prolonged neomycin use may cause villous atrophy leading to loss of zinc and an increased incidence of diarrhea.

DRUG NUTRIENT INTERACTION

- Lactulose can cause diarrhea and loss of Na and fluid loss.
- Antibiotics cause decreased gastrointestinal bacterial synthesis of vitamin K.
- Aminoglycosides result in increased loss of K, Mg and calcium due to altered excretion.
- Beta-blockers increase protein oxidation and increase the dietary protein requirements.

GENERAL NUTRITIONAL GUIDELINES FOR HEPATITIS AND LIVER DISEASE

- No alcohol.
- No protein restriction
- Caloric intake
- Salt restriction
- Late bed-time meal
- Avoidance of processed food.
- Liberal consumption of fresh organic fruits and vegetables.
- Avoidance of smoking.
- Avoidance of excessive caffeine
- Vitamin D and calcium supplement.

THANK

YOU

*A flower
to express
my true
appreciation*

