
Hepatitis C Choices in Care

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Nutrition and Supplementation

Lyn Patrick, ND

Diet in Hepatitis C: The basics

- Calorie needs are higher than usual in liver disease.
- Protein needs are higher than normal in liver disease (except in late cirrhosis)
- Fat intake should be limited and focused on omega-3 oils.

Calories = Energy

- Caloric need: average 150 lb. adult requires 2,000- 2,500 calories/day
- To calculate average calorie needs:
Body weight (in pounds) x 14-16

Where do calories come from?

- Calories come from carbohydrates, fats and proteins.
- Fats have twice the energy content for the same amount of food, which is why they are a good energy source for athletes or people living in cold climates (Antarctica) compared to proteins and carbohydrates (starch and sugar).

Protein

Proteins are chains of amino acids.

- There are 20 amino acids.
- Nine amino acids cannot be made by the body and must be obtained from food sources.
 - These are called the essential amino acids.

Protein

- Proteins help build the structure of all the tissues of the body such as hair, nails, skin, eyes, and our organs.
- Proteins are used to form enzymes, hormones, and various body fluids and secretions.

Protein

- Antibodies of the immune system are proteins.
- Proteins called lipoproteins help transport of fats (cholesterol) and fat-soluble vitamins (vitamin A,D,E,K).
- Proteins help regulate fluid balance in the body.

Protein:

Bioavailability and Biological Value

These terms refer to the usefulness of a protein to the body.

- **Bioavailability** describes the ease with which nutrients can be absorbed and utilized by the body.
- **Biological Value** is a measure of protein quality, assessed by how well a protein supports nitrogen retention in humans.

Protein Needs

- An average 150 lb. adult requires 75-105 grams of protein per day (except advanced cirrhosis).
- To calculate daily protein need in grams:
Body weight (in lbs.) x .5-.7

Protein Ratings of Foods

Whey Protein isolates blends	110-159
Whey Concentrate (lactalbumin)	104
Whole Egg	100
Cow's milk	91
Egg white	88
Fish	83
Beef	80
Chicken	79
Casein (milk protein)	77
Soy	74
Rice	59
Wheat	54
Beans	49

Protein

- Adequate protein is necessary for liver regeneration and ammonia detoxification.
- Adequate protein intake is even more important if you have cirrhosis because the liver's ability to make proteins may be impaired.

Protein

- Vegetable protein is an important source of protein in the diets of people with hepatitis.
 - People with advanced cirrhosis can decrease their risk of encephalopathy by decreasing animal protein and increasing vegetable proteins.
- Vegetable protein is usually lower in fat and has lower iron availability than animal protein.
 - Vegetable iron is 2-5% absorbable while animal sources are between 10-20% absorbable.

Protein

To create balance in your protein intake:

- Limit animal protein to approximately 50% of protein intake.
- For 150 lb. person, this would mean about 45 grams per day of fish or chicken (a 6-ounce serving).

Fats

- Fats are long chains of building blocks called **fatty acids**.
- There are:
 - “good fats” that we require
 - “bad fats” that we can do without
 - fats that are neither good nor bad, but need to be eaten in moderation

Fats

- Between 1997 to 2000, the per capita daily consumption of added fats jumped 16%, from 56 grams to 65 grams per day.
- The average daily intake of total fat in the United States is:
81.4 grams (96.5 g for males and 67.3 g for females).
- The recommendation for daily fat consumption- no more than 53 grams for a 1600 calorie diet.

Saturated Fats

Saturated fats include butter, whole milk, cream, eggs, red meat, chocolate, and solid shortenings.

- An excess intake of saturated fat can raise blood cholesterol and increase the risk of developing coronary artery disease.
- Saturated fat needs to be eaten in moderation.

Trans Fats:

The Baddest of the Bad

The majority of *trans* fat is formed when liquid oils are made into solid fats like shortening and hard margarine.

- Heating liquid oils to high temperatures creates trans fats.

Trans Fats: The Baddest of the Bad

The intake of trans fatty acids:

- ❑ increases blood LDL ("bad" cholesterol)
- ❑ decreases HDL ("good cholesterol")
- ❑ raises the risk of coronary heart disease

In 2003, Denmark banned the production and import of all trans-fatty acid containing foods.

Trans Fats: The Baddest of the Bad

- Trans fats increase the shelf-life of oils and are found in vegetable shortenings, margarine, mass-produced crackers, cookies, snack foods, pastries, pizza, potato chips, french fries, cookies, and bread.
- If the ingredient list includes the words *shortening*, *partially hydrogenated vegetable oil* or *hydrogenated vegetable oil*, the food contains trans fat.

The Food and Drug Administration has decreed that by Jan. 1, 2006, manufacturers must break the trans fats category out of the total fat listing on food labels.

Sample Label for
Macaroni and Cheese

Start Here

Limit these
Nutrients

Get Enough
of these
Nutrients

Footnote

Nutrition Facts	
Serving Size 1 cup (228g)	
Servings Per Container 2	
Amount Per Serving	
Calories 250	Calories from Fat 110
% Daily Value*	
Total Fat 12g	18%
Saturated Fat 3g	15%
Trans Fat 1.5g	
Cholesterol 30mg	10%
Sodium 470mg	20%
Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Quick Guide
to % DV

5% or less
is low
20% or more
is high



Omega-3 Fatty Acids

- Essential fatty acids are polyunsaturated fatty acids the body needs to function, but cannot produce. Therefore, they have to be acquired from foods.
- Omega-3 fatty acids are a class of essential polyunsaturated fatty acids that have beneficial effects on the body.

Omega-3 Fatty Acids

1,800 Greenland Eskimos were studied in a survey over a 25-year period.

- Results showed they had a lower risk and often a complete absence of diseases such as heart attacks, diabetes, asthma, multiple sclerosis, and psoriasis.
- Researchers believe this is because their diet is rich in the omega-3 fatty acids EPA and DHA from fish.

Omega-3 Fatty Acids

- Foods high in omega-3 fatty acids include salmon, halibut, sardines, albacore, trout, herring, walnut, flaxseed, hempseed, black currant, borage or fish oils and canola oil.
- Fish oil (EPA/DHA) is a good source of omega-3 fatty acids.

Omega-3 Fatty Acids

Foods rich in omega-3 fatty acids (salmon, sardines, plant oils) may have an anti-inflammatory effect on the liver in chronic hepatitis.

Omega-3 Fatty Acids

In a small trial, omega-3 fatty acids (fish oil, 2 grams twice daily) were found to significantly reduce ALT levels after 12 weeks in people with chronic hepatitis C.

Gross JB, Czaplewski LA, Brandhagen DJ.
Mayo Clinic, unpublished data.



Omega-3 Fatty Acids

- Fresh flaxseed, hempseed, black currant, borage and fish oils are good sources of omega-3 fatty acids.
- 2 grams twice daily may be difficult for those with digestive problems
 - a smaller dose of 500 mg once or twice daily is also used

Dietary Fat Recommendation

- A low-fat diet (20-30%) is recommended.
 - ❑ majority of fats from omega-3 containing fats, cold-pressed oils, and nuts/seeds
 - ❑ low-fat dairy products, fish, and chicken
 - ❑ minimal or no red meat

MyPyramid.gov



MyPyramid.gov

- Grains: 3 oz. whole grains daily = 1 ½ cups cooked brown rice
- Veggies: 2 ½- 3 cups dark green and orange fresh veggies, beans/peas
- Fruits: 1 ½ cups- 2 cups fruit
- Oils: 5-7 teaspoons daily
- Milk or milk substitutes: 3 cups
- Meat/Beans/Nuts/Seeds: 5-6 oz.

Milk Substitutes

- Calcium fortified juices, cereals, breads, soy beverages, or rice beverages
- Canned fish (sardines, salmon with bones) soybeans and other soy products (soy-based beverages, soy yogurt, tempeh), some other dried beans, and some leafy greens (collard and turnip greens, kale, bok choy).

Protein Sources

One ounce of protein in:

- 14 walnuts
- 1 egg
- 1 cup beans
- 1/6 chicken breast

Food Pyramid Exceptions

- **Hepatic encephalopathy**
 - possibly need to decrease protein until symptoms are controlled.
- **Ascites**
 - limit salt in foods: cheese, nuts, crackers, etc.
- **Lactose intolerance**
 - avoid dairy or take an enzyme supplement
- **Diabetes**
 - avoid simple carbohydrates (sugar and fruit juices); eat frequently

Food Pyramid Exceptions

- Cirrhosis
 - eat small frequent meals including complex carbohydrates to avoid blood sugar swings
- Inability to digest and absorb fats
 - may need to switch to MCT oil (medium-chain triglyceride) or coconut oil, and decrease fat-containing foods such as nuts, cheese, fatty fish (salmon, sardines), etc.

Warning Signs of Cirrhosis

- Sleep problems- awake at night, tired during the day
- clumsiness
- Confusion, memory loss that gets worse
- Jaundice
- Muscle wasting
- Swollen feet and abdomen
- Red palms and soles of feet
- Spider veins

Hepatic Encephalopathy

- In liver failure, the liver is unable to metabolize ammonia and unable to receive the ammonia from the gut (portal- systemic shunting).
- Ammonia builds up and circulates to the brain causing brain cell swelling.

Problems with Fat Digestion

- Decrease in bile salt concentration
 - fat malabsorption
 - fat-soluble vitamin deficiencies (A,D, E, K)
 - steatorrhea (fat in stool)
- Solution
 - Lipase-containing digestive enzymes (pancreatin) can aid fat malabsorption

Hepatic Encephalopathy

- May be present in 50-70% of cirrhotics
- Treatment aimed at reducing ammonia levels in intestine and liver.
 - lactulose or lactitol lowers colonic pH and alters bacterial growth
 - antibiotics also given to eliminate bacteria that produce ammonia

Hepatic Encephalopathy

Protein restriction may also be used to treat hepatic encephalopathy.

– ovo-lacto vegetarian diet with low protein

Hepatic Encephalopathy

- L-carnitine- 2 grams daily works as well as lactulose in lowering blood ammonia levels.

Hepatic Encephalopathy

- Probiotics

- *Enterococcus faecium*, *Lactobacillus acidophilus* and other probiotics help control ammonia-forming organisms in gut and decrease portal hypertension.

- *Enterococcus f.* has been shown to be effective in reducing ammonia levels in hepatic encephalopathy.

Fatty Liver

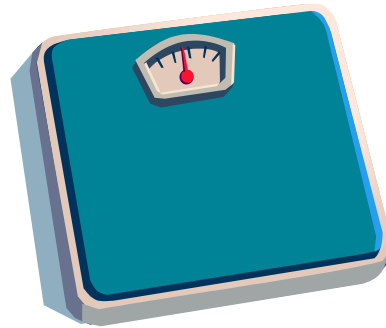
- Fatty liver (steatosis) is common in hepatitis C.
 - present in over 50% of those infected.
- Risk factors for fatty liver are:
 - genotype 3: 2/3 have evidence of fatty liver
 - diabetes
 - excess body weight
 - insulin resistance
 - alcohol consumption

Can Weight Loss Improve Fatty Liver?

- YES!
 - Weight loss of as little as 5% of body weight can decrease steatosis.
- Healthy body weight is considered a body mass index (BMI) of 25 or less.

Metabolism and Body Weight

- Exercise burns calories and helps us maintain or achieve a healthy body weight.
- Healthy body weight is particularly important for people with chronic hepatitis C.



Body Mass Index (BMI)

$$\text{BMI} = \frac{\text{Weight (in kg)}}{\text{Height}^2 \text{ (in m)}}$$

$$\text{BMI} = \frac{\text{Weight (in lbs.)} \times 703}{\text{Height}^2 \text{ (in inches)}}$$

BMI calculator available online at <http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm>



Body Mass Index (BMI)

BMI	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

BMI and Hepatitis C: What you need to know

- People with high BMIs have a higher incidence of fatty liver.¹
- Fatty liver is associated with disease progression in people with chronic hepatitis C,² especially those with genotype 3.

1 Solis-Herruzo JA, et al. Am J Gastroenterol. 2005 May;100(5):1091-8.

2 Gordon A, et al. J Hepatol. 2005 Jul;43(1):38-44.

BMI and Hepatitis C: What You Need to Know

HCV-infected patients with significant amounts of liver fat have **lower response rates** to interferon-based therapy than those without fatty liver disease.^{1, 2}

1 Harrison SA, et al. Clin Gastroenterol Hepatol. 2005 Jun;3(6):604-9.

2 Akuta N, et al. J Med Virol. 2005 Apr;75(4):550-8.



BMI and Hepatitis C: What You Need to Know

Modest weight loss and physical activity in overweight patients with chronic liver disease results in **sustained improvements in ALT, fasting insulin, and quality of life.**

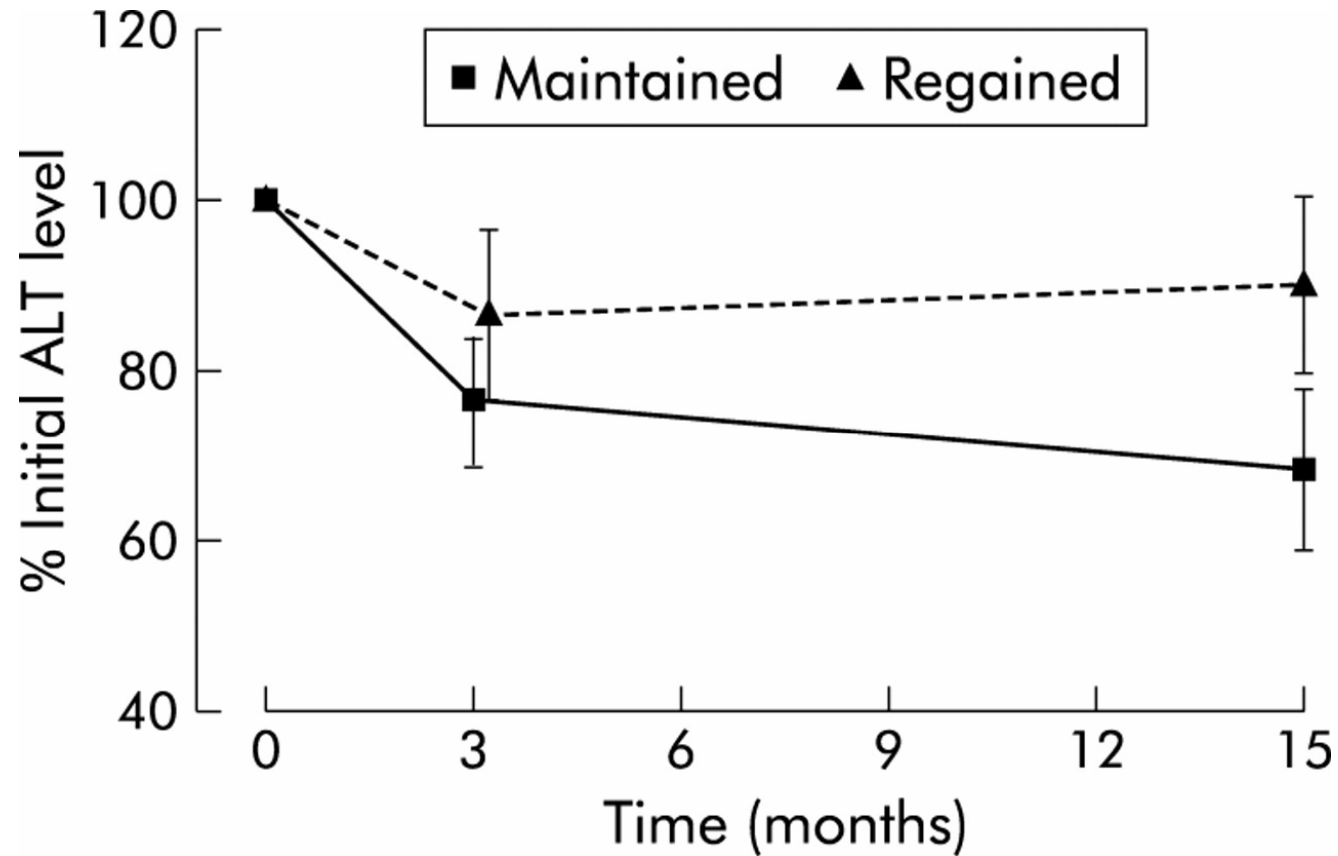
- ❑ Patients were on a 3-month weight loss program followed by a 12-month maintenance program.
- ❑ Participants performed 2 ½ hours of aerobic exercise per week during the weight loss period.

Results of Weight Loss and Exercise in Chronic Liver Disease

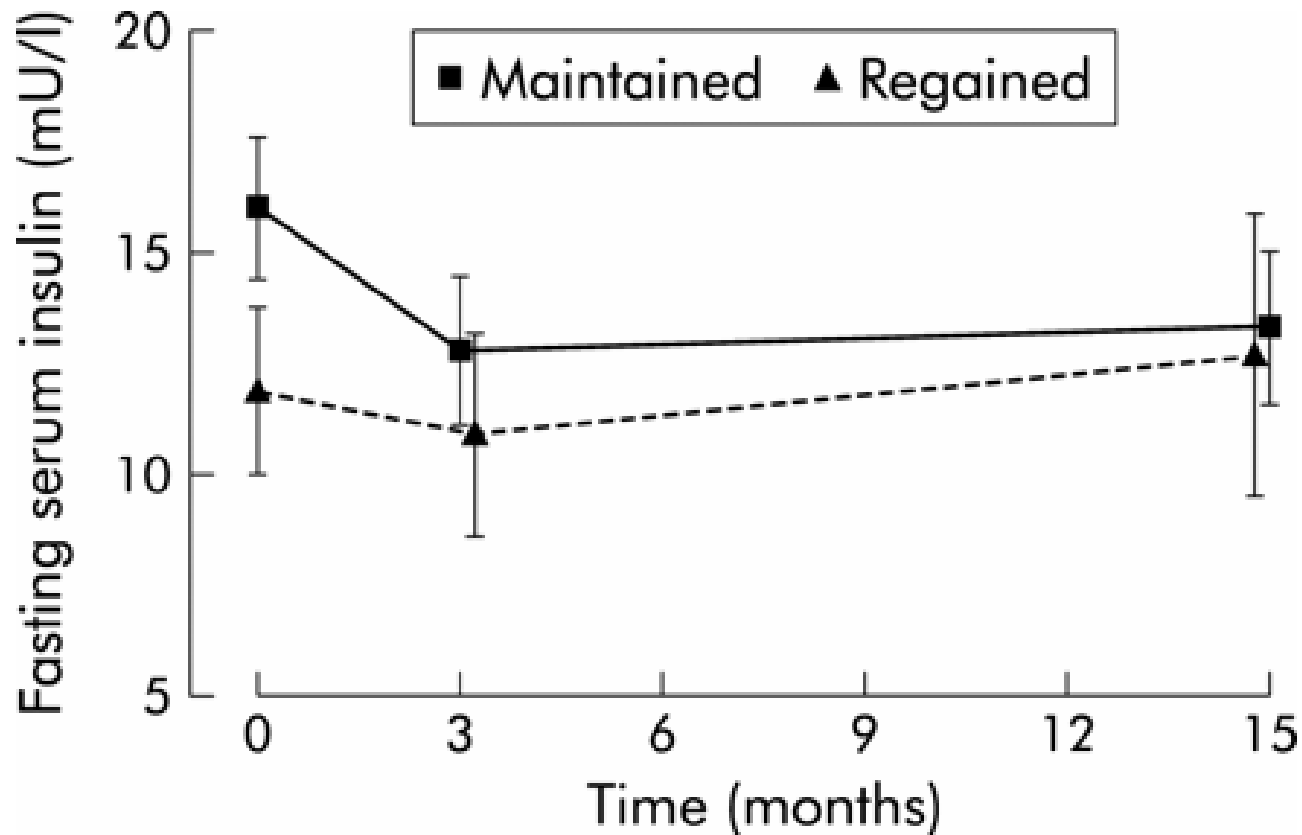
Participants lost an average of **5.8%** of their body weight during the 3-month weight loss period.

- At 15 months, 68% had maintained their weight loss.
- Those who **maintained their weight loss continued to exercise** during the maintenance phase of the study.
- Those who regained weight did not continue to exercise at the recommended level during the follow-up maintenance period.

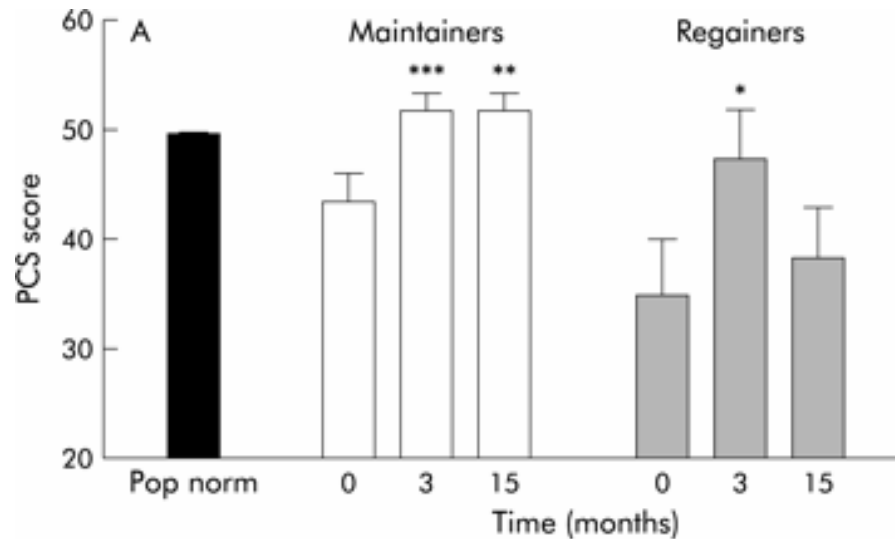
ALT Decreased in Proportion to Weight Loss



Insulin Decreased in Proportion to Weight Loss



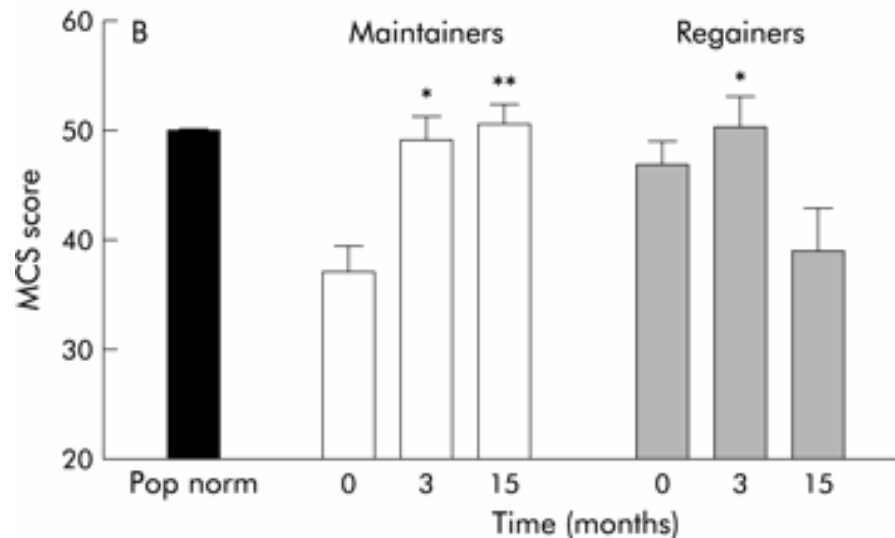
Improved Quality of Life with Weight Loss



Pop norm = population norm

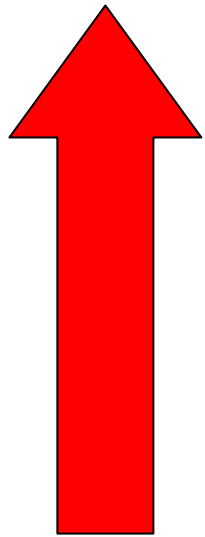
PSC = physical scale

MCS = mental scale



higher score = higher quality of life

Exercising for a Healthy Body Weight



Metabolic rate

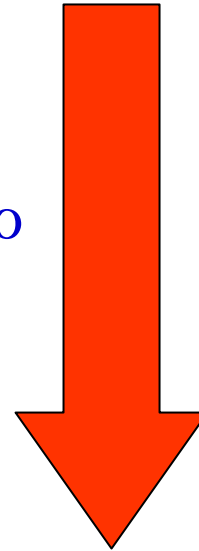
Efficiency of blood sugar use

Potential response rate to IFN-based therapy

Energy

Mood

Quality of life



Insulin resistance

Liver enzymes

Risk of fatty liver

Risk of blood sugar abnormalities

Risk of abnormal fat deposits in the blood vessels

Risk of other diseases

Fatty Liver

- A man weighing 157 pounds who is 5'5" has a BMI of 26.1
 - go to www.medcalc.com to calculate your BMI
- A loss of 1 lb. per week for 2 months will equal an 8 lb. loss (5% of body weight) – enough to make a difference in the actual amount of fat stored in the liver.

How to Lose Weight

A *secret* formula is revealed that PROMISES weight loss with no side effects:

Exercise More

Eat Less

Improve Insulin Sensitivity

What is Insulin Resistance?

- loss of the ability to recognize insulin and allow sugar into the cell
- leads to increased production of insulin in order to compensate
- characterized by high blood insulin levels

Who Has Insulin Resistance?

- 20-25% of people in the U.S population have insulin resistance
- Over 30% of all chronic hepatitis C patients have insulin resistance or diabetes.
- Those with chronic hepatitis C who are over age 40 have **3** times the risk of developing insulin resistance or type 2 diabetes.

What to Do About Insulin Resistance: Eat Low Glycemic Foods

Examples of foods with a low glycemic index include those with higher fiber content such as:

- ❑ whole grain breads
- ❑ brown rice
- ❑ non-starchy vegetables including broccoli, green beans, asparagus, carrots, and greens

What to Do About Insulin Resistance

- Some carbohydrates are broken-up and absorbed faster than others.
 - This is called a high **glycemic index**.
 - These carbohydrates increase the blood sugar rapidly and require the secretion of more insulin to control the blood sugar level.
 - Examples include: sugars, white breads, and unrefined corn products such as bagels, mashed potatoes, doughnuts, corn chips, and french fries.

What to Do About Insulin Resistance

- If needed, lose weight to get to a BMI of 19-25.
- Eat low on the glycemic index.
- Eliminate high fructose-containing foods such as soda and bottled fruit juices.
- Exercise.
- Get 8 hours of good quality sleep every night.

Insulin Resistance

- In the last 20 years, soft drink consumption has increased by 40%
- 440 12 oz cans of soda per person every year
- High fructose corn syrup intake has increased more than 1000% in the last 20 years
- The incidence of obesity has doubled in the last 20 years

Insulin Resistance

- “Increased consumption of fructose may contribute to insulin resistance”

Nutritional Supplementation in Hepatitis C

Antioxidants

Minerals

Amino acids

Nutritional co-factors

Why are Antioxidants Important in Hepatitis C ?

Cellular damage occurs in an environment that is high in free radicals and low in antioxidants.

- ❑ This causes cellular damage (inflammation and fibrosis) that occurs as a result of the interaction between the hepatic immune cells and the viral infection.

Antioxidants and Fibrosis

Blood levels of the antioxidants glutathione, vitamin A, vitamin C, vitamin E, and selenium are much lower in HCV+ persons when compared to people the same age and sex who do not have hepatitis C.

Antioxidants in Hepatitis C

- Glutathione is the main antioxidant in liver and all mammalian tissue.
- Glutathione is a sulfur-containing protein that is used in detoxification, immune function, and antioxidant protection in the liver as well as all tissues in the body.
- Glutathione levels are low in people with hepatitis C.

Glutathione and Antioxidants

- Vitamins E and C, alpha-lipoic acid, selenium, and co-enzyme Q help recycle glutathione so it can continue to work as an active antioxidant, detoxification protein, and immune stimulator.
- Silymarin has been shown to raise liver glutathione levels 35%, and is more potent than vitamin E as an antioxidant.

Antioxidants and Fibrosis

- Markers of oxidant stress in those with HCV and low antioxidant levels were closely connected to the amount of fibrosis in the liver.
- The higher the oxidant stress, the more advanced the fibrosis. Fibrosis was also connected to low levels of antioxidants in the blood.

Antioxidants and Fibrosis

- Those in the study with significantly elevated ALT levels (over 100) had the most significant vitamin E deficiencies.
- Genotype 1b had the lowest glutathione levels of all genotypes.

Vitamin A

- High doses of supplemental vitamin A can be toxic to the liver.
- Supplements may be necessary in cases of vitamin A deficiency
- It is safer to supplement with beta-carotene or mixed carotenoids.

Selenium and Liver Cancer

- In a study of 7,342 men with HBV or HCV, those with the highest selenium levels were 40% less likely to get liver cancer than those with the lowest levels.
- 200 mcg of yeast-based selenium decreased the incidence of liver cancer in HBV endemic area of China by 33%.
- Selenium deficiencies more significant in co-infection (HIV/HCV).
- Selenomethionine or yeast-based selenium is safest and most absorbable.

Yu MW *Am J Epidemiol.* 1999;150(4):367-374

Yu SY *Biol Trace Elem Res.* 1997;56(1):117-124.



Zinc

- Zinc has been shown to be one of the nutrients that may be deficient in those with hepatitis C.
- Zinc may be useful in the prevention and treatment of hepatic encephalopathy.

Zinc

- Zinc is less absorbable in those with cirrhosis.
 - Zinc is twice as absorbable in those with cirrhosis when taken between meals.
- Zinc citrate, picolinate, septahydrate are more absorbable than zinc oxide, gluconate, or sulfate.

Vitamin E

- Fat soluble vitamin found in oils, cereal grains, animal fats, fruits, and vegetables.
- Naturally occurring vitamin E consists of a complex of 8 different forms found in foods:
 - ❑ alpha-tocopherol
 - ❑ beta-tocopherol
 - ❑ gamma-tocopherol
 - ❑ delta-tocopherol
 - ❑ 4 types of tocotrienols

Vitamin E

- Most of the vitamin E found in food is gamma-tocopherol.
- Most of the commercially available vitamin E and the form used in many studies is synthetic L-alpha tocopherol isomer (not the d-form).
- The forms used in the recent meta-analysis were not disclosed but can be assumed to be alpha-tocopherol only and probably the L-isomer.

Vitamin E

Synthetic vitamin E (l-alpha tocopherol with no other tocopherols or tocotrienols) has ability to bind to receptor sites, potentially in favor of biologically active forms of vitamin E (d-alpha-, beta-, delta-, and gamma-tocopherol) and may even be harmful.

“Vitamin E over 400 IU is Harmful”

- 135,967 participants in 19 clinical trials.
 - Of these trials, 9 tested vitamin E alone and 10 tested vitamin E combined with other vitamins or minerals.
 - The dosages of vitamin E ranged from 16.5 to 2000 IU/d (median, 400 IU/d).
- Conclusion: high-dosage (>400 IU/d) vitamin E supplements may increase all-cause mortality and should be avoided.

Vitamin E Study

Data showing harmful effects of vitamin E involve subjects with vascular risk factors or who had established cardiovascular disease (CVD).

In contrast, the DATATOP and ADCS studies cited in the study utilized mega-doses of vitamin E (2000 IU/day) in individuals with neurodegenerative disorders rather than CVD, but did not reveal safety concerns with vitamin E.

Vitamin E Study

“In summary, we have trouble accepting the conclusions regarding high dose vitamin E due to the statistical methods used and the lack of controlling for study quality and publication or selection bias. We contend that correction of any one of these factors could negate the marginally significant results. With these problems and multiple other studies suggesting vitamin E has no effect of mortality, telling our patients that it may be harmful seems premature.”

Vitamin E

- May improve response to interferon.
- 1200 IU for 8 weeks in HCV+ completely blocked the biochemical pathway leading to fibrosis.
- Vitamin E at 1200 IU is contraindicated in coumadin therapy and with vitamin K deficiency.

■ Look MP, et al. *Antiviral Res.* 1999;43(2):113-122.

■ Houglum K *Gastroenterology.* 1977;113(4):1069-1073



Vitamin E

The most biologically accurate form of vitamin E is the complex:

- ❑ alpha, beta, delta, gamma tocopherol and alpha, beta, delta and gamma tocotrienol

Alpha-Lipoic Acid (ALA)

- ALA has been used to treat diabetic peripheral neuropathy and acute liver failure in Europe.
- Because it is active in both fatty tissue and non-fatty tissue, it has a wide range of activity as an antioxidant.

www.voy.com/17059/190.html for an interview with
Lester Packer PhD, ALA researcher



ALA vs. NAC

- ALA is effective at a lower molecular concentration and a lower dose:
 - 450 mg raised glutathione levels in HIV+ in 14 days
- Doses of 600 mg equivalent in animal and in vitro studies have raised glutathione levels significantly.

S-Adenosyl Methionine (SAMe)

- Used in Europe to normalize bile secretion in chronic liver disease.
- Studies in HBV and HCV showed reduction of itching, jaundice, fatigue, and lowering of bilirubin in median of 16 days.
- Dosages used: 800-1600 mg daily
- Difficulties: cost and storage (easily oxidized)