

## **Pantothenic Acid** (Vitamin B<sub>5</sub>)

Cholesterol, a soft, waxy, fat-like substance, is found in every cell of the body. It is needed to help digest fats, strengthen cell membranes, insulate nerves, and make hormones. Made primarily by the liver, our body makes all the cholesterol that we actually need, but we also get additional cholesterol from the foods that we eat. The highest sources of cholesterol are egg yolks and organ meats including liver and kidney.

Peanut butter, avocado, and all other plant-derived foods contain no cholesterol. However, all foods from animal sources do contain cholesterol. Even though cholesterol is responsible for many important functions in the body, too much cholesterol in the bloodstream can be very dangerous. Once blood cholesterol has reached high levels, it builds up on artery walls, and therefore increases the risk of blood clots, heart attack, and stroke. Because the heart is a muscle, it needs a constant supply of oxygen and nutrients. The bloodstream, which transports these nutrients to the heart through coronary arteries, cannot transport the oxygen if the arteries become narrowed or clogged by cholesterol and fat deposits. Depending on the severity, this can result in coronary heart disease, angina, or heart attack.

Because cholesterol and other fats cannot dissolve in the blood, they cannot travel on their own. Instead, they are transported to and from cells by special carriers called lipoproteins. There are two major lipoproteins: low density lipoproteins (LDL) or bad cholesterol, and high density lipoproteins (HDL) or good cholesterol. LDLs cause atherosclerosis because they clog up our arteries with the continual buildup of fat. On the other hand, HDL prevents fat buildup by carrying it away from the arteries to the liver, where it can be processed and eliminated.

Triglycerides, which are fats used as fuel by the body, can make the

blood more sluggish and less capable of transporting oxygen when in high amounts. There are many medications prescribed by physicians for people with elevated triglyceride levels. Some of the most effective, and most harmful, are the statins. The all-natural combination of pantethine and plant sterols can safely lower triglycerides and LDL cholesterol levels, while increasing HDL cholesterol.

The body uses pantothenic acid (better known as vitamin B<sub>5</sub>) to make proteins as well as other important chemicals needed to metabolize fats and carbohydrates. Pantothenic acid is also used in the manufacture of hormones, red blood cells, and acetylcholine, an important neurotransmitter (signal carrier between nerve cells). Pantethine itself is a combination of pantothenic acid (vitamin B-5) and beta mercaptoethylamine. Pantethine is the precursor to coenzyme A, the critical starting point in the Krebs energy production cycle.

As a supplement, pantothenic acid has been proposed as a treatment for rheumatoid arthritis, enhancing sports performance, and fighting stress in general.

In the body, pantothenic acid is converted to a related chemical known as pantethine. For reasons that are not clear, pantethine supplements (but not pantothenic acid supplements) appear to reduce blood levels of triglycerides and possibly also improve the cholesterol profile.

Pantethine is a highly absorbable and biologically active form of pantothenic acid. Pantethine forms the reactive component of Coenzyme A (CoA) and the acyl-carrier protein (ACP). CoA and ACP are extensively involved in carbohydrate, lipid, and amino acid metabolism. It is also essential in producing, transporting, and releasing energy from fats and has been reported to lower blood levels of cholesterol and triglycerides.

Some studies indicate that pantethine may favorably affect lipids and protect against forms of cardio muscular disease. Additionally, it has been shown to protect against a number of toxins, including alcohol. Preliminary research leads researchers to believe that pantethine may influence various central nervous system and adrenal junctions, but no useful conclusions can yet be drawn from these early investigations. While it has been suggested that pantethine supplementation may enhance exercise performance and inhibits hair loss and graying of hair, there is no evidence to suggest that either of these claims are true.

### **Requirements/Sources**

The word *pantothenic* comes from the Greek word meaning “everywhere,” and pantothenic acid is indeed found in a wide range of foods. For this reason, pantothenic acid deficiency is rare. The official recommendations for daily intake of pantothenic acid are as follows:

#### **Infants**

0-6 months: 1.7 mg

7-12 months: 1.8 mg

#### **Children**

1-3 years: 2 mg

4-8 years: 3 mg

9-13 years: 4 mg

#### **Males and Females**

14 years and older: 5 mg

**Pregnant Women:** 6 mg

**Nursing Women:** 7 mg

Brewer's yeast, torula (nutritional) yeast, and calf liver are excellent sources of pantothenic acid. Peanuts, mushrooms, soybeans, split peas, pecans, oatmeal, buckwheat, sunflower seeds, lentils, rye flour, cashews, and other whole grains and nuts are good sources as well, as are red chili peppers and avocados. Pantethine is not found in foods

in appreciable amounts. Pantethine, a form of pantothenic acid that is found in liver, salmon, and yeast, is known for its ability to lower cholesterol by blocking its production. The production of cholesterol in the human body is a very complex process, involving many biochemical reactions and enzyme activity. Pantethine inhibits several of these enzymes, blocking the activity of those coenzymes involved in cholesterol synthesis by about 50%. To compensate for the lowered cholesterol production, the liver pulls LDL out of the bloodstream, resulting in a lower total cholesterol level.

### **Plant sterols**

Plant sterols, which are the fats of plants, are found in nuts, vegetable oils, corn, and rice. They are structurally very similar to cholesterol and are therefore able to act as a stand in for cholesterol and block its absorption, causing it to be eventually excreted. If we eat enough plant sterols, the amount of cholesterol transported from the intestinal tract to the liver is greatly reduced. Just like pantethines, they have similar effect on the liver; this cholesterol reduction causes the liver to pull LDL cholesterol out of the blood, which reduces both total and LDL cholesterol levels.

If the plant sterol and pantethine found in our food just are not enough to have much of an effect on our health, we need to take a concentrated combination of pantethine and plant sterols in just the right ratio. Plant sterols, which are bound in fibers in the plants, can not be adequately consumed even if we ate lots of raw fruits and vegetables. There are also several forms of plant sterols, with some ratios of these plant sterols being more beneficial than others. While pantethine is found in several food sources, it is hard to get beneficial amounts from our food alone unless we plan the intake properly. Recent studies have shown that lowering cholesterol in people without heart disease can greatly reduce their risk for ever developing CHD, along with heart attacks and atherosclerosis. This is also true for those with high cholesterol levels and for those with average cholesterol levels. Most physicians would prescribe statin drugs to

people without actual heart disease or high cholesterol levels causing of the many health risks of the drugs. However, the combination of pantethine and plant sterols are very effective in helping those people with heart disease, high cholesterol levels, high triglyceride levels, as well as those just wanting the extra health insurance for their hearts. Pantethine and plant sterols are both very safe. Although some people may experience a mild upset stomach when first taking pantethine, taking the combination of pantethine and plant sterols with meals can usually solve this problem.

### **Therapeutic Dosages**

For lowering triglycerides, the typical recommended dosage of pantethine is 300 mg 3 times daily. Dosages of pantothenic acid as high as 660 mg 3 times daily are sometimes recommended for people with rheumatoid arthritis.

### **Therapeutic Uses**

Inconsistent evidence from small double-blind trials suggest that pantethine might lower blood levels of triglycerides and, to a lesser extent, cholesterol. High triglycerides, like high cholesterol, increase risk of heart disease and strokes. Some people have only modestly elevated cholesterol but very high triglycerides, so pantethine may be especially useful for them.

Weak evidence hints that pantothenic acid might be helpful for rheumatoid arthritis.

Pantothenic acid is also recommended as an athletic performance enhancer, but there is no evidence at all that it works. It is also sometimes referred to as an anti-stress nutrient because it plays a role in the function of the adrenal glands, but whether it really helps the body withstand stress is not known.

### **Scientific Evidence for Pantothenic Acid and Pantethine**

## **High Triglycerides/High Cholesterol**

Three small double-blind, placebo-controlled studies suggest that pantethine can reduce total blood triglycerides and perhaps improve cholesterol levels as well. For example, a double-blind placebo-controlled study followed 29 people with high cholesterol and triglycerides for 8 weeks. The dosage used was 300 mg 3 times daily, for a total daily dose of 900 mg. In this study, subjects taking pantethine experienced a 30% reduction in blood triglycerides, a 13.5% reduction in LDL (“bad”) cholesterol, and a 10% rise in HDL (“good”) cholesterol. However, other small studies have found no benefit. These contradictory results do not necessarily mean that pantethine is ineffective, as chance plays a considerable role in the outcome of small studies. Rather, they suggest that larger studies need to be performed to establish (or disprove) pantethine’s potential efficacy.

Several open studies have specifically studied the use of pantethine to improve cholesterol and triglyceride levels in people with diabetes and found it effective without causing harmful effects.

These findings are supported by experiments in rabbits, which show that pantethine may prevent the build-up of plaque in major arteries. However, we do not know how pantethine acts in the body to reduce triglycerides.

## **Rheumatoid Arthritis**

There is weak evidence for using pantothenic acid to treat rheumatoid arthritis. One observational study found 66 people with rheumatoid arthritis had less pantothenic acid in their blood than 29 healthy people. The more severe the arthritis, the lower the blood levels of pantothenic acid was. However, this result does not prove that pantothenic acid supplements can effectively reduce any of the symptoms of rheumatoid arthritis.

To follow up on this finding, researchers then conducted a small placebo-controlled trial involving 18 subjects to see whether pantothenic acid would help. This study found that 2 g daily of pantothenic acid (in the form of calcium pantothenate) reduced morning stiffness, pain, and disability significantly better than placebo. However, a study this small does not mean much on its own.

### **Hypolipidemic effect of pantothenic acid derivatives (including pantethine) in mice with hypothalamic obesity induced by aurothioglucose.**

The hypolipidemic effects of pantothenic acid derivatives (phosphopantothenate, panthenol and pantethine) were studied in mice with hypothalamic obesity. Hypothalamic obesity in mice was induced by single injection of aurothioglucose (300 mg/kg body wt, i.p.). All the tested substances were administered during the last 10 days before decapitation (i.m., of dosage equivalent to 150 mg/kg body wt of phosphopantothenate). The studied substances inhibited the weight gain of the animals with hypothalamic obesity over the last 10 days of the experiment. The treatment with aurothioglucose increased food intake and mean body weight, blood glucose level; insulin, serum total cholesterol, triglyceride, the sum of LDL + VLDL and LDL-cholesterol concentration; triglyceride and cholesterol fractions in the liver; triglyceride and FFA content as well as lipoprotein lipase activity in adipose tissue of experimental mice. The administration of the assay compounds lowered food intake and mean body weight, insulin and glucose levels and decreased the content of triglycerides, total cholesterol and cholesterol esters in serum and adipose tissue as well as raised the activity of lipoprotein lipase in adipose tissue and serum lipolytic activity in obese mice. Among the compounds studied the reverse effect of panthenol was especially pronounced. The mechanism of hypolipidemic effects of pantothenic acid derivatives can be related to the reduced resistance to insulin and activation of lipolysis in serum and adipose tissue.

## **The effects of pantethine on fatty liver and fat distribution**

Although the prognosis of fatty liver depends on its causes, clinical experience is that fatty liver with hypertriglyceridemia has a good prognosis and responds well to treatment. In this study, 600 mg/day of pantethine was administered to 16 outpatients with fatty liver and hypertriglyceridemia for six months or longer to examine whether the drug improved fatty liver using abdominal plain computed tomography (CT). Nine of the 16-pantethine patients were no longer diagnosed as having fatty liver after the study period. A chi2 test indicated the significant disappearance of fatty liver. At the same time, the visceral fat calculated from the CT image passing the umbilical region was also significantly reduced. On the contrary, the subcutaneous fat area tended to increase, so the ratio of the visceral-to-subcutaneous fat area was reduced significantly. This indicates triglycerides may be pooled in the body as hepato-visceral fat and subcutaneous fat, and that pantethine may transfer fat from the liver and viscera to the subcutaneous tissue. This suggests that visceral fat deposition and fatty liver occurring with hypertriglyceridemia may have a common basis, probably excessive matrixes, and that pantethine may simultaneously improve the two conditions.

More research is needed.

### **Safety Issues**

No significant side effects have been reported for pantothenic acid or pantethine, used by themselves or with other medications. As noted above, pantethine has been used in people with diabetes, without apparent adverse effects. However, maximum safe dosages for young children, pregnant or nursing women, or people with serious liver or kidney disease have not been established.

This sublingual precursor to coenzyme B-5 (also called coenzyme A) goes directly into your bloodstream in its active form, ready to go to



work immediately. This avoids loss that may occur not only during digestion, but during the liver's conversion process as well.