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Homocysteine

What Is It?

Homocysteine (pronounced homo-SIS-teen) is an amino acid and is found normally in the body. Its metabolism is linked to that of several vitamins, especially folic acid, B6, and B12. Deficiencies of those vitamins may cause elevated levels of homocysteine.

How Can It Effect Me?

In recent years, studies have accumulated suggesting that a high level of homocysteine increases a person's chance of developing heart disease, stroke, and peripheral vascular disease (a reduced blood flow to the hands and feet).

Research

In September 1995, the National Heart, Lung, and Blood Institute (NHLBI) convened a special panel to review the scientific evidence about homocysteine's possible link to heart disease. The information that follows is based on the panel's conclusions.

Briefly, the panel said that an elevated homocysteine level appears to increase the risk of heart disease, stroke, and peripheral vascular disease. However, no studies have been done to show that lowering the homocysteine level reduces the risk of heart disease. The panel stressed that more research, especially a clinical trial, must be done to understand the possible association between the level of homocysteine and heart and related diseases.

HOMOCYSTEINE AND HEART DISEASE

Various studies have found that persons with elevated levels of homocysteine in their blood are at an increased risk of heart and vessel disease. These studies include the Physicians' Health Study, the Tromso Study from Norway, the Framingham Heart Study, and a meta-analysis of nearly 40 studies. Some studies indicate that persons with elevated homocysteine levels tend to also have other risk factors for heart disease, especially smoking, high blood pressure, and high blood cholesterol. So far, no clinical trial has been done to show that lowering homocysteine levels alters the progression of heart disease, or prevents heart attacks or strokes.

WHY HOMOCYSTEINE?

Much more basic research must be done before scientists understand how an elevated homocysteine level affects the development and progression of heart disease. However, scientists have several theories: First, a high level of homocysteine may be involved with the process called atherosclerosis, the gradual buildup of fatty substances in arteries. Homocysteine also may make blood more likely to clot by increasing the stickiness of blood platelets. Clots can block blood flow, causing a heart attack or stroke. Increased homocysteine may affect other substances involved in clotting too. Finally, higher

homocysteine levels may make blood vessels less flexible--and so less able to widen to increase blood flow. However, none of theories has so far been proven.

WHAT DETERMINES HOMOCYSTEINE LEVELS?

Individuals differ in their levels of homocysteine. Two key factors affect a person's homocysteine level--genetics and environment.

- **Genetics.** Genetic factors help regulate the level of homocysteine in the blood. For instance, genetic flaws (mutations) can affect homocysteine's metabolism. The NHLBI Family Heart Study found families with genetic mutations in the enzymes involved in homocysteine metabolism. The NHLBI Framingham Heart Study and other investigations have found a relationship between elevated homocysteine levels and families with early heart disease.
- **Environment.** The level of homocysteine in the blood also is affected by the consumption of vitamins, especially folic acid, B6, and B12. Data from the Framingham Heart Study show that only 30-40 percent of the population was getting 200 or more micrograms of folic acid in their diet. The data indicated that for many persons an intake of at least 400 micrograms was needed to keep homocysteine levels from becoming elevated. Data also indicate that homocysteine levels are higher in older persons than younger ones, and in women after menopause than in those before. But more research is needed to confirm and explain these differences.

SOURCES OF FOLIC ACID, B6, AND B12: Americans who follow a well-balanced diet should get enough vitamins, including folic acid, B6, and B12. There are no data to support the benefit of taking a folic acid supplement for heart and vessel diseases. Some food sources of folic acid, B6, and B12 are given below. The list includes sample percentages of the recommended daily value (RDV) for each vitamin. These RDVs are: 400 micrograms for folic acid, 2 milligrams for B6, and 6 micrograms for B12.

Folic acid, also called folate: More than a third of the folic acid in most Americans' diet comes from citrus fruits, tomatoes, and vegetables. Grain products also are an important source of folic acid. For example, 1/2 cup of spinach gives at least a third of the RDV for folic acid. A 1/2 cup of asparagus, broccoli, or green peas gives 10-24 percent of the RDV. An 8-ounce glass of orange juice and 1/2 cup of asparagus each has about a quarter of RDV. Americans also can use beans and lentils as sources of folic acid. A 1/2 cup of black-eyed peas, lentils, lima beans, pinto beans, or navy beans gives at least a third of the RDV for folic acid.

Vitamin B6: Americans' major sources of vitamin B6 are meat, poultry, fish, fruits, vegetables, and grain products. For example, 1 banana has up to 40 percent of the RDV for B6. One baked potato, a 1 3/4-cup serving of watermelon, or a 3-ounce serving of salmon or turkey gives up to a quarter of the RDV for B6.

Vitamin B12: Americans' major sources of vitamin B12 are meat, poultry, fish, and milk and milk products. B12 is not found in fruits, vegetables, beans, grains, nuts, or seeds. For example, a 3-ounce serving of mackerel or trout has more than 40 percent of the RDV for B12. A 3-ounce serving of tuna has up to 40 percent of the RDV for B12. One

cup of nonfat plain yogurt has about a quarter of the RDV for B12.

Some foods, such as breakfast cereals, have folic acid and other nutrients added to them. Check the food label for the RDV for folic acid.

Beginning in January 1998, certain foods will be required by the U.S. Food and Drug Administration to add folic acid in order to help prevent birth defects, such as spina bifida. These foods include enriched breads and rolls, all enriched flours, corn meals, all enriched macaroni and noodle products, and breakfast cereals. Food labels may say the product has been fortified with folic acid.

WHAT LIES AHEAD?

It is not yet definitely known if elevated homocysteine is a risk factor for heart disease--that is, if it really increases a person's chance of developing heart disease.

Known risk factors for heart disease are age (being 45 or older for men; 55 or older for women), a family history of early heart disease, high blood pressure, high blood cholesterol, smoking, obesity, physical inactivity, and diabetes.

Until more research is done, Americans can protect their health by following a heart-healthy food plan. Those concerned about homocysteine should talk to their doctor. The September NHLBI panel called for more research to help answer the many questions about homocysteine's possible role in the development and progression of heart disease and stroke. These questions include:

- Does homocysteine damage blood vessel walls?
- What regulates the level of homocysteine in the blood and how?
- What happens to heart disease when homocysteine levels drop?
- What are the differences in homocysteine levels among men and pre- and post-menopausal women?
- If significant differences exist, why?
- Can keeping homocysteine levels low prevent heart disease and stroke?
- Can reducing homocysteine levels prevent repeat heart attacks?
- What is the best amount and of which vitamins to prevent heart attack and stroke?
- Does the homocysteine level interact with known modifiable risk factors for heart disease?