1. Lipoprotein(a) Connection

Fifty percent of Americans have elevated serum cholesterol levels. And the increase occurs naturally as we age. In men, most of the increase occurs after about age 45. In women, most of the increase occurs after age 55, and especially after menopause. **The goal for cholesterol management is to lower the blood level of bad (low-density lipoprotein, or LDL)- cholesterol and increase the level of good (high-density lipoprotein, or HDL-) cholesterol as its job is to mop up LDL-cholesterol.** There is no question that lowering dietary intake of cholesterol and saturated fats prevent heart disease because it lowers blood LDL-cholesterol levels.

Cholesterol levels alone cannot explain many heart attack deaths. Autopsy studies of heart attack victims, however, show that a good percentage of heart attack victims have clean vessels and ideal lipoprotein levels. It is obvious that there are other causes for heart disease than the traditional. Indeed, researchers with the Framingham Heart Study (the decades-long study that brought us the term "risk factor") identified a relative of LDL-cholesterol called lipoprotein(a) [Lp(a)], which is now recognized as **MAJOR** independent risk factor for heart disease. **Lp(a) fosters the deposition of cholesterol on artery walls as well as interferes with the body's means of dissolving clots. Lp(a) fosters cholesterol deposition by enhancing oxidation of LDLcholesterol. It is the oxidized form of cholesterol that penetrates the endothelium, leading to the build up of plaque and vascular disease.**

Some researchers believe that cardiovascular disease is primarily caused by chronic deficiencies of vitamins and other essential nutrients with defined biochemical properties, such as coenzymes, cellular energy carriers, and antioxidants. Chronic depletion of these essential nutrients in endothelial and vascular smooth muscle cells impairs their ability to function properly. Take the effects of **Vitamin C (ascorbic acid) deficiency** as an example. Humans are one of a few animals that cannot produce ascorbate. Humans must get Vitamin C from external sources. Deficiency of Vitamin C leads to a disease called scurvy, the symptoms of which are caused the reduced ability of the body to make collagen, an essential component of wound healing, bones and joints, and blood vessels.

Chronic ascorbate deficiency leads to impairment in the structure of the blood vessel walls and tiny lesions in its inner wall. These changes are the hallmarks of early atherosclerosis. Atherosclerotic plaques can develop as the result of an overcompensating

repair mechanism consisting of deposition of systemic plasma and local cellular response which includes extra cellular accumulation of Lp(a) and fibrinogen/fibrin at the site of injury. This repair mechanism is exacerbated primarily at sites of hemodynamic stress. This explains why the most frequent clinical manifestation of cardiovascular disease such as myocardial infarction, is the local development of atherosclerotic plaques in coronary arteries.

As a result of confirmation in animal studies, ascorbate with other essential nutrients is now being recommended for the prevention and treatment of cardiovascular diseases. Mathias Rath and colleague conducted a yearlong study to determine the effect of a defined nutritional supplementation program on the natural progression of coronary artery disease. He gave 55 patients with various stages of coronary artery disease, aged 44-67, a daily nutritional supplementation program including 2,700 mg of Vitamin C, vitamin B complex, 600 IU of Vitamin E (d-alpha-tocopherol), 450 mg of L-proline, 450 mg of L-lysine, 390 mcg of folic acid, 30 mg of coenzyme Q-10, and 450 mg of citrus bioflavinoids. Changes in the progression of coronary artery calcification before and during the program were determined by Ultrafast Computerized Tomography. Before the intervention, the natural progression rate of the coronary artery calcification averaged 44% per year.

However, during the year of treatment, the progression of coronary artery calcification decreased by an average of 15%. In a subgroup of patients with early stages of coronary artery disease, treatment resulted in a statistically significant decrease, with no further progression of coronary calcification. In individual cases, reversal and complete disappearance of previously existing coronary calcification were documented. This landmark study, published in the Journal of Applied Nutrition (1996, 48:3), showed that **coronary artery disease could be effectively prevented and treated by natural means. In patients with early coronary calcification, progression was halted. In individual cases with small-calcified deposits, nutritional supplement intervention led to the complete disappearance of the deposits.**

It is postulated that the nutrients used by Rath initiate the reconstitution of the vascular wall. Ascorbate is essential for the synthesis and hydroxylation of collagen. **L-lysine and L-proline are important substrates for the biosynthesis of matrix protein and competitively inhibit the binding of lipoprotein(a) to the vascular matrix.** Maintaining the integrity and physiological function of the vascular wall is the key therapeutic target in controlling cardiovascular disease.

It is worth noting that Vitamin C, being water-soluble, is cleared through the body very quickly, giving it a very short half-life. To maintain continuous optimum levels of Vitamin C in the body, ascorbate should be taken in divided dosages throughout the day. To overcome this problem, a fat-soluble form of Vitamin C, ascorbyl palmitate, has been developed. It is readily absorbed from the gastrointestinal track and finds its way to the micro-capillaries where it stays to exerts its health enhancing properties mentioned above. The amount of each nutrient required to prevent the onset of disease states is outlined in the Recommended Dietary Allowances (RDAs). As of July 2000, the RDA for Vitamin C is 60 mg per day. This is about the amount present in one RED and will prevent scurvy.

The amount for optimum health however, is less well defined. Humans, other primates, and guinea pigs do not produce ascorbate endogenously. **Guinea-pigs fed a diet low in ascorbate, an amount equivalent to the usual human intake, rapidly developed atherosclerotic plaques, similar to those found in humans. When large amounts of supplementary ascorbate were given to these guinea pigs, there was a regression in plaque formation.** Linus Pauling, two-time Nobel Laureate, postulated that Lp(a) may be the surrogate for ascorbate in the human. Low dietary intake of ascorbate leads to weakened blood vessels because ascorbate is required for the synthesis of collagen and elastin, which strengthen the blood vessel wall. In the absence of sufficient ascorbate, Lp(a) is mobilized to repair these structural defects in arterial walls by being deposited to strengthen the tissue. However, if the plasma concentration of Lp(a) is too high, the process goes too far. Too much Lp(a) gets deposited in the arterial wall, and plaque formation is initiated.

Dr. Pauling concluded that the optimum intake of Vitamin C is perhaps 100 times more than the RDA. During the last 25 years of his life (he died at age 93 from cancer), Dr Pauling increased his own intake of Vitamin C from 50 time to 300 times the RDA, taking 3,000 mg to 18,000 mg per day. This amount is consistent with the amount of ascorbate in animals that is capable of producing their own on a daily basis. It is fair to say that Dr. Pauling believed that cardiovascular disease is the general result of ascorbate deficiency.

Preventive Nutritional Supplement Consideration:

Ascorbyl Palmitate: 200 – 400 mg; L-Lysine: 200 – 400 mg; L-Proline: 200 – 00 mg;
Ascorbate: 1,000 – 3,000 mg