

CLINICAL APPLICATIONS OF SPECTRACELL'S MICRONUTRIENT TESTS IN CARDIOVASCULAR PATIENTS

Although much progress has been made, cardiovascular disease (CVD) remains the leading cause of death in the United States. Micronutrient deficiencies have been found to contribute to adverse cardiovascular events and are associated with disease process and the overall condition of your health. Years of research has implicated vitamins B6, B12, folic acid, calcium, magnesium and antioxidants as important in the metabolism of homocysteine, the proper function of heart muscle and in scavenging free radicals respectively. Unfortunately, these and other important nutrients are depleted by drug treatments commonly used for CVD, further compromising the patient's health.

DRUGS AND THEIR EFFECT ON NUTRITIONAL STATUS

DRUG	NUTRIENT	POTENTIAL HEALTH PROBLEM(S)
Hydralazine-containing Vasodilators	Vitamin B6 Coenzyme Q10	Anemia, tiredness, weakness, increased cardiovascular disease risk Various cardiovascular problems, weak immune system, low energy
Loop Diuretics Furosemide (Lasix), Bumetanide (Bumex), Ethacrynic acid (Edecrin)	Calcium Magnesium Potassium Vitamin B1 Vitamin B6 Vitamin C Sodium Zinc	Osteoporosis, heart & blood pressure irregularities, tooth decay Cardiovascular problems, asthma, osteoporosis, cramps, PMS Irregular heartbeat, muscle weakness, fatigue, edema Depression, irritability, memory loss, muscle weakness, edema Depression, sleep disturbance, increased cardiovascular disease risk Lowered immune system, easy bruising, poor wound healing Muscle weakness, dehydration, memory problems, loss of appetite Weak immunity, wound healing, sense of smell/taste, sexual dysfunction
Thiazide Diuretics Hydrochlorothiazide (HCTZ), Methylclothiazide (Enduron), Chlorothiazide (Diuril), Indapamide (Lozol), Metolazone (Zaroxolyn), Chlorthalidone (Hygroton), etc.	Magnesium Potassium Zinc Coenzyme Q10 Sodium	Cardiovascular problems, asthma, osteoporosis, cramps, PMS Irregular heartbeat, muscle weakness, fatigue, edema Weak immunity, wound healing, sense of smell/taste, sexual dysfunction Various cardiovascular problems, weak immune system, low energy Muscle weakness, dehydration, memory problems, loss of appetite
Potassium-sparing diuretics Dyazide, Maxzide, Triamterene (Dyrenium)	Calcium Folic Acid Zinc	Osteoporosis, heart & blood pressure irregularities, tooth decay Birth defects, cervical dysplasia, anemia, cardiovascular disease Weak immunity, wound healing, sense of smell/taste, sexual dysfunction
Cardiac Glycosides Digoxin (Lanoxin)	Vitamin B1 Calcium Magnesium Phosphorus	Depression, irritability, memory loss, muscle weakness, edema Osteoporosis, heart & blood pressure irregularities, tooth decay Cardiovascular problems, asthma, osteoporosis, cramps, PMS Weakness, low energy, skeletal problems
Aspirin & Salicylates	Vitamin C Calcium Folic Acid Iron Potassium Sodium Vitamin B5	Lowered immune system, easy bruising, poor wound healing Osteoporosis, heart & blood pressure irregularities, tooth decay Birth defects, cervical dysplasia, anemia, cardiovascular disease Anemia, weakness, fatigue, hair loss, brittle nails Irregular heartbeat, muscle weakness, fatigue, edema Muscle weakness, memory loss, dehydration Fatigue, listlessness and possible skin problems
HMG-CoA Reductase Inhibitors Fluvastatin (Lescol), Atorvastatin (Lipitor), Simvastatin (Zocor), Lovostatin (Mevacor), Pravastatin (Pravacol)	Coenzyme Q10	Various cardiovascular problems, weak immune system, low energy
Bile Acid Sequestrants Cholestyramine (Atromid-S), Colestipol (Colestid)	Vitamins A, D, E, K B12, Beta-Carotene, Calcium, Magnesium, Zinc, Iron Folic Acid, Phosphorus Vitamins A, D, E, B12 Beta-Carotene, Folic Acid, Iron	

NUTRIENTS SPECIFICALLY IMPORTANT TO CARDIOVASCULAR DISEASE

In addition to common depletions by drug therapies used to treat disease conditions related to heart disease these nutrients have extra significance in treating heart disease patients:

CoQ10	Various cardiovascular problems, weak immune system, low energy
Calcium	Heart & blood pressure irregularities, osteoporosis, tooth decay
Magnesium	Cardiovascular problems, asthma, osteoporosis, cramps, PMS
Potassium	Irregular heartbeat, muscle weakness, fatigue, edema
Vitamin B6	Increased cardiovascular disease risk, depression, sleep disturbance
Vitamin B12	Increased cardiovascular disease risk, anemia, tiredness, weakness
Folic Acid	Cardiovascular disease, birth defects, cervical dysplasia, anemia
Vitamin E	Hearing disease risk, weak immune system, increased free radical damage
Carnitine	Elevated blood lipid levels, abnormal liver function, muscle weakness, less energy, impaired glucose control

NUTRIENTS TESTED BY SPECTRACELL'S MICRONUTRIENT AND CARDIOVASCULAR TESTS

Vitamin A	Asparagine	Lipoic Acid
Vitamin B1	Calcium	Magnesium
Vitamin B2	Carnitine	Oleic Acid
Vitamin B3	Choline	Selenium
Vitamin B6	Chromium	Serine
Vitamin B12	Coenzyme Q10	SPECTROX® Total Antioxidant Function
Vitamin C	Copper	Zinc
Vitamin D	Cysteine	
Vitamin E	Fructose Sensitivity	
Vitamin K2	Glucose/Insulin Metabolism	
Biotin	Glutamine	
Inositol	Glutathione	
Folate		
Pantothenate		

COMMON RELATED DIAGNOSIS CODES

414.00	Coronary atherosclerosis, of native coronary artery	266.2	Other nutritional deficiency
401.10	Essential Hypertension, benign	272.00	Pure hypercholesterolemia
401.90	Essential Hypertension, unspecified	780.20	Syncope and collapse
272.40	Hyperlipidemia, other and unspecified	786.05	Shortness of breath
269.30	Mineral Deficiency, unspecified	786.06	Tachypnea
269.90	Nutritional deficiency, unspcied	785.20	Undiagnosed cardiac murmurs
769.40	Other abnormal clinical findings	286.2	Vitamin deficiency, unspecified

COMPARISON: MICRONUTRIENT TESTING & OTHER NUTRITIONAL ASSAYS

	Micronutrient Testing	Metabolite Excretion	Enzyme Activation Index	Microbial Growth Assays
Measure a combination of cellular functions for each micronutrient?	YES	NO	NO	NO
Measure ability to support normal metabolic functions?	YES	NO	NO	NO
Determines individual functional requirements?	YES	NO	NO	NO
Demonstrate the intracellular function simultaneously?	YES	NO	NO	NO
Reflect average of long-term nutritional history (over three months)?	YES	NO	NO	NO
Use living cells from the patient?	YES	NO	NO	NO
Identify biochemical individuality?	YES	NO	NO	LIMITED

DYSLIPIDEMIA

Manganese

Cofactor to an antioxidant (superoxide dismutase) that repairs damage to blood vessels caused by oxidized LDL (low density lipoprotein).^{1,2}

Magnesium

Deficiency causes pro-atherogenic (heart-disease causing) changes in lipoprotein metabolism; Protects LDL (low density lipoprotein) from being oxidized.^{3,4}

Vitamin C

Protects LDL from oxidation, thus making it less “sticky” and prone to atherosclerosis (clogging of arteries); Prevents white blood cells (monocytes) and oxidized LDL from sticking to blood vessel wall; Lowers Lp(a) in some people.^{5,6,7}

Vitamin D

Suppresses foam cell formation thus reducing risk of lipid-related arterial blockages; Deficiency linked to dyslipidemia.^{8,9}

Vitamin B3

Niacin (B3) effectively lowers the highly atherogenic Lp(a) by decreasing its rate of synthesis in the liver.^{10,11}

Vitamin B5

Favorably alters low density lipoprotein metabolism and reduces triglycerides; Full benefit of lipid lowering effects may not be seen for up to four months.^{12,13}

Carnitine

In supplementation trials, carnitine lowers triglycerides, oxidized LDL and the atherogenic Lp(a); This effect is likely due to its role in transporting fatty acids into cells so they can be used as fuel.^{14,15,16}

Lipoic Acid

Improves lipid profile by reducing small, dense LDL (dangerous type); Protects vascular lining from oxidized cholesterol.^{17,18}

Additional nutrients affect lipid metabolism. This list is non-exhaustive.

Inositol

Decreases small, dense LDL especially in patients with metabolic syndrome; Lowers triglycerides.^{19,20,21}

Choline

Regulates HDL metabolism; Part of the enzyme lecithin-cholesterol acyltransferase that has a major impact on lipoprotein metabolism.^{22,23}

Chromium

Specifically improves the dyslipidemia that accompanies insulin resistance; May increase HDL; Synergistic effect with niacin (B3) for dyslipidemia.^{24,25,26}

Coenzyme Q10

It is well established that statins, often prescribed for dyslipidemia, deplete CoQ10; Lowers Lp(a) and improves efficacy of some dyslipidemia meds.^{27,28}

Copper

Several copper-dependent enzymes affect lipoprotein metabolism; Deficiency contributes to fatty buildup in arteries caused by dyslipidemia.^{29,30,31}

Selenium

Prevents post-prandial (after a meal) changes in lipoproteins that make them susceptible to oxidation and thus harmful.^{32,33}

Zinc

Suboptimal zinc raises dangerous lipoproteins that promote vascular inflammation and arterial plaque formation; Cellular zinc controls the gene that makes heart-protective HDL (high density lipoprotein).^{34,35,36}

Hypertension

Zinc Regulates angiotensin and endothelin, two enzymes that directly affect blood pressure; Deficiency causes blood vessels to constrict. ^{37,38}

Copper Regulates enzymes that keep blood vessels dilating properly; Depletion causes hypertension; Supplementation trials positive. ^{34,35,36}

Magnesium Promotes dilation of blood vessels; Low intracellular levels are a well established cause of hypertension. ^{31,32,33}

Calcium Optimal calcium status reduces vasoconstriction; Particularly effective for salt-sensitive hypertension as it increases sodium excretion. ^{9,29,30}

Folate Lowers blood pressure by improving endothelial function, or the ability of blood vessels to properly dilate. ^{27,28}

Carnitine Lowers blood pressure in the same way as ACE inhibitors, a common hypertension drug which reduces angiotensin, a substance that causes arteries to constrict; Its role in fat metabolism explains this effect. ^{25,26}

Oleic Acid The benefits of olive oil for blood pressure are largely due to its high oleic acid content, which protects endothelial cells (inner lining of blood vessels) from inflammation. ^{22,23,24}

Cysteine Anti-hypertensive effects stem from its role as a potent antioxidant; Effective vasodilator. ^{20,21}

Lipoic Acid Improves vascular tone; Causes vasodilation; Works like calcium channel blocker meds; Recycles vitamins C, E and Cysteine. ^{18,19}

Glutathione Oxidative stress, which often manifests as glutathione deficiency, can induce hypertension. ^{39,40}

Biotin Pharmacological doses reduce systolic blood pressure by activating an enzyme (cGMP) that causes smooth muscle to relax. ^{1,2}

Vitamin A Suppresses the growth of vascular smooth muscle, thus keeping blood vessels (lumen) clear and wide. ^{3,4}

Vitamin B2 People with a certain gene (called MTHFR type TT) tend to respond well to B2 therapy for lowering blood pressure. ^{5,6}

Vitamin B6 Lowers homocysteine, a toxin that makes arteries stiff and raises blood pressure; Low B6 is strongly linked to hypertension. ^{6,7,8,9}

Vitamin C Improves the ability of blood vessels to react appropriately to relaxation signals; Increases nitric oxide, a powerful vasodilator. ^{9,10,11}

Vitamin D Low vitamin D is strongly linked to hypertension, possibly due to its role in calcium transport; Augments blood pressure lowering effect of calcium; Keeps blood vessels smooth and healthy. ^{9,12,13}

Vitamin E Increases nitric oxide synthase, an enzyme that causes blood vessels to dilate; Protects blood vessels from damage. ^{14,15}

Coenzyme Q10 Improves bioenergetics of blood vessel wall; Deficiency highly correlated to hypertension; Benefits of CoQ10 often not seen for several weeks. ^{9,16,17}

Additional nutrients affect blood pressure. This list is non-exhaustive.