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Individual Nutrients Can Impact Your Resistance and Susceptibility to Infection

Cold and flu season may be months away, but it's not too early to think about ways to boost your resistance to infection. In a group of recent articles, researchers reviewed the research on several nutrients and how they influence – positively or negatively – our ability to fight infections.

Andrew M. Prentice, PhD, of the London School of Hygiene and Tropical Medicine, and his colleagues noted that micronutrients are “critical to the optimal functioning of the host’s immune response.” Think of yourself as the “host” for disease-causing germs.

Prentice pointed out that both people and infectious germs can compete for the same nutrients, but often use them in very different ways. He pointed out that iron is especially problematic. It’s an essential nutrient, but bacteria need it to grow. Iron supplements can actually fuel infections, essentially by feeding the biochemical requirements of bacteria.

In a separate paper, Conor P. Doherty, MB, of the Royal Hospital for Sick Children in Glasgow, Scotland, explained that the body generally tries to withdraw, or sequester, iron during infection and inflammation. However, bacteria have developed ways to tap into the body’s iron reserves.

Doherty pointed out that dietary iron overload in some African groups is associated with a 3.5-fold greater risk of developing tuberculosis. Ironically, iron deficiency anemia protects against malaria, and iron deficiency is common and advantageous in areas where malaria is common.

“Iron-deficient infants and young children do benefit from iron supplementation with improvement in cognition and possibly growth,” Doherty wrote. “In areas of intense malaria transmission and endemic iron deficiency, whole population iron supplementation is dangerous....Unless the host immune response is impaired by severe iron deficiency, there is rarely an urgency to supplement iron.”

Ananda S. Prasad, MD, PhD, of the Wayne State University School of Medicine, Detroit, wrote that zinc is essential for normal functioning of the thymus

gland, which makes the hormone thymulin along with T-helper 1 (Th₁) immune cells. A lack of zinc reduces the activity of thymulin and Th₁, creating an imbalance with T-helper 2 (Th₂) cells. That imbalance leads to reduced activity of still other immune cells and impaired infection-fighting ability.

In one study cited by Prasad, people taking 30 mg of zinc gluconate daily for one year experienced almost one-fifth fewer infections – including colds, flus, and cold sores – compared with people taking placebos.

“Even a mild deficiency of zinc in humans may be accompanied by an imbalance of Th₁ and Th₂ cells,” wrote Prasad.

Finally, Melinda A. Beck, PhD, of the University of North Carolina, Chapel Hill, described research on how deficiencies of either selenium or vitamin E increase the virulence, or aggressiveness, of common viruses. Beck and her colleagues had previously shown that a deficiency of these nutrients impairs normal immune function.

But low levels of selenium or vitamin E also lead to genetic changes in the flu virus and coxsackie virus. These changes alter a relatively mild virus, creating more dangerous mutations that easily spread to other people.

Beck also cited a 2004 study in which subjects received live polio virus vaccines. People who had low selenium levels showed evidence of an increased mutation rate in the polio virus. In contrast, people who were given selenium supplements did a better job of removing the virus from their bodies.

References: Prentice AM, et al. Host-pathogen interactions: can micronutrients tip the balance? *Journal of Nutrition*, 2007;137:1334-1337. Doherty CP. Host-pathogen interactions: the role of iron. *Journal of Nutrition*, 2007;137:1341-1344. Prasad AS. Zinc: mechanisms of host defense. *Journal of Nutrition*, 2007;137:1345-1349. Beck MA. Selenium and vitamin E status: impact on viral pathogenicity. *Journal of Nutrition*, 2007;137:1338-1340. □

Perspectives...**The Glycemic Index: Another Fad?**

The glycemic index, once discussed by only academic nutrition researchers, has become the latest dietary fad. In theory the glycemic index makes sense, but in practice it often has little to do with good nutrition, losing weight, or preventing diabetes.

The index ranks foods based on how strongly they provoke an increase in blood sugar. Foods that trigger high blood sugar levels create a diabetic-like response, first with elevated blood sugar and then followed by low blood sugar and feelings of hunger. Conversely, foods that prompt a negligible or modest blood-sugar response are more likely to reduce hunger, appetite, and weight.

The first problem with the glycemic index is that it demands that people carry around a book listing the glycemic index of foods, which is all too similar to the books for counting calories, carbs, and fats. It's not intuitive, and it's a big hassle.

The second problem is that low-glycemic foods aren't always healthy. Fettucini, spaghetti, ice cream, and M&M peanut candies are relatively low on the glycemic index, but they're hardly examples of good nutrition.

The third problem is that low-glycemic foods can become an excuse for eating less-than-nutritious foods. Just as people have a habit of over-eating low-carb and low-calorie foods, they may be tempted to over-indulge in low-glycemic carbs. When you eat more, your meal moves up on the glycemic index.

The fourth problem is that glycemic responses to foods are highly individualized, often influenced by food allergies and physical activity. In addition, person with insulin resistance will have a higher glycemic response than would a healthy person.

Eating low-glycemic foods *is* a good habit. But it's simpler to just think in terms of healthy foods. When your diet is primarily fish, chicken, high-fiber vegetables and fruits, with very small amounts of carbs, you'll be eating a low-glycemic diet. The difference is that you'll actually be thinking in terms of good nutrition, without any need to refer to an index, calories, or grams of carbs and fats. —JC

N-Acetylcysteine, a Widely Used Antioxidant, Helpful in Cocaine Abuse

A recent study found that just over 10 percent of American adults develop problems with drug use or abuse at some point in their lives. At about the same time, another study added to the evidence supporting a powerful natural treatment for drug abuse.

Pascale N. Mardikian, MD, of the Medical University of South Carolina, Charleston, and his

colleagues used N-acetylcysteine (NAC) to treat 23 cocaine users. Mardikian and his colleagues gave the cocaine users 1,200 mg, 2,400 mg, or 3,600 mg of NAC daily, in divided doses, for four weeks. The primary objective of the study was to confirm NAC's well-known safety, and the secondary objective was to track changes in cocaine use.

NAC is a potent antioxidant and immune stimulant. It's sold in health food stores and stocked in every hospital emergency room for acetaminophen (Tylenol) overdose. Dosages of about 10,000 mg daily are commonly used to treat acetaminophen poisoning. Acetaminophen depletes the liver's levels of glutathione, another powerful antioxidant, and NAC restores glutathione.

Seven of the subjects dropped out of the study. Of the remaining 16 patients, the NAC supplements had a dramatic effect on cocaine use, particularly at the higher doses. Overall, cocaine use dropped from about eight days in the month before treatment to only one day during the month of NAC treatment. In addition, the amount of money the patients spent on cocaine decreased from almost \$1,300 in the month before treatment to just over \$50 during NAC treatment.

"For the 16 subjects who completed the study, nine subjects terminated use of cocaine completely during the medication phase, five subjects substantially decreased their use, and two demonstrated no change in cocaine use," wrote Mardikian.

He added, "Given that there was no formal psychotherapy component and no compensation provided, the rates for the higher doses are exceptionally high compared to literature on compliance rate in cocaine pharmacotherapy trials."

Reference: Mardikian PN, LsRowe SD, Hedden S, et al. An open-label trial of N-acetylcysteine for the treatment of cocaine dependence: a pilot study. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 2007;31:389-394. □

Mother's High Intake of Vitamin D May Reduce Child's Risk of Wheezing

Mothers who consume a lot of vitamin D, from either foods or supplements, are less likely to have children with wheezing problems.

Carlos A. Camargo Jr, MD, DrPH, of the Harvard Medical School, and his colleagues used a dietary questionnaire to assess the vitamin D intake of 1,194 women during their pregnancy. Camargo then tracked the health of their children, 16 percent of whom developed wheezing by age three.

Women with the highest intake of vitamin D – an average of 724 IU daily – were 59 percent less likely to have children with wheezing problems.

Each increase of 100 IU of daily vitamin D intake, was related to about a one-fifth lower risk of wheezing.

Previous research has found that low levels of vitamin D is related to poorer lung function.

“Vitamin D insufficiency is common in the United States, especially in northern latitudes,” wrote Camargo. This insufficiency is multifactorial but probably stems from a combination of decreased dietary intake of vitamin D (e.g., from fortified milk or fish) and decreased sun exposure (e.g., because of lifestyle choices or increased use of sunscreen).”

Reference: Camargo CA, Rifas-Shiman SL, Litonjua AA, et al. Maternal intake of vitamin D during pregnancy and risk of recurrent wheeze in children at 3 y of age. *American Journal of Clinical Nutrition*, 2007;85:788-795. □

Certain Types of Cooking Can Increase Inflammation and Vascular Problems

Advanced glycation endproducts (AGEs), also known as glycotoxins, are associated with accelerated aging. AGEs are known to trigger increases in free radicals and inflammation, and they can attach to DNA, disrupting its normal programming.

AGEs are formed when sugars fuse to proteins, blocking the normal function of the protein. Although some AGEs are formed within the body, others are found in foods, especially those cooked at high temperatures for long periods. For example, broiling, roasting, deep frying, and grilling generate large numbers of AGEs, compared with boiling, steaming, or stewing. Processed foods also contain larger amounts of AGEs compared with raw foods.

In a recent study, Helen Vlassara, MD, of the Mount Sinai School of Medicine, New York City, and her colleagues compared the effects of food-derived AGEs in 172 people, some of whom were relatively young and others who were older.

The subjects’ blood levels of AGEs, as well as markers of inflammation and free radicals, increased after they ate foods rich in AGEs.

The more AGE-laden foods the subjects ate, the higher their blood levels of AGEs, inflammation, and free radicals. In addition, the subjects’ insulin resistance, an indicator of diabetes risk, also increased.

“AGEs are excreted by the kidneys, the normal capacity of which may be easily exceeded, especially in the presence of renal disease, diabetes, or high AGE intake,” wrote Vlassara.

In a separate study, Diethelm Tschoepe, MD, of Ruhr University Bochum, Germany, and colleagues, fed 20 type-2 diabetic patients diets containing either low-AGE or high-AGE diets during a six-day study. The foods were exactly the same

except for the temperature at which they were cooked and the length of cooking time. The high-AGE diet contained five times more AGEs compared with the low-AGE diet.

Tschoepe then measured the effects of the two diets on blood flow and blood vessel tone, as well as microcirculation and free radical levels. After the high-AGE diet, the subjects averaged a 36 percent decrease in “endothelial function” – a marker of blood vessel tone and blood flow. The low-AGE diet decreased endothelial function by almost 21 percent. The effect on large blood vessel tone was paralleled by a 67 percent reduction in microvascular circulation from the high-AGE diet and an almost 24 percent reduction from the low-AGE diet.

“We speculate that a chronic high-AGE diet, like most Western diets are, could lead over weeks or months to a persistent endothelial dysfunction and thus contributes to the development of the micro- and macrovascular complications of diabetes mellitus,” wrote Tschoepe.

Reference: Uribarri J, Cai W, Peppas M, et al. Circulating glycotoxins and dietary advanced glycation endproducts: two links to inflammatory response, oxidative stress, and aging. *Journal of Gerontology – Medical Sciences*, 2007;62A:427-433. Negrean M, Stirban A, Stratmann B, et al. Effects of low- and high-advanced glycation endproduct meals on macro- and microvascular endothelial function and oxidative stress in patients with type 2 diabetes mellitus. *American Journal of Clinical Nutrition*, 2007;85:1236-1243. □

Too Much Phosphorus, Found in Soft Drinks, May Increase Heart Risks

High levels of phosphorus, an essential nutrient, may increase the risk of cardiovascular diseases, according to a study in *Archives of Internal Medicine*.

Phosphorus is found widely in the food supply, but the major dietary source is now phosphoric acid, found in soft drinks. The mineral is also found in many food additives, as well as in the form of phytic acid in cereals and legumes.

Ravi Dhingra, MD, of the U.S. National Heart, Lung, and Blood Institute, and his colleagues analyzed data collected over 16 years from 3,368 people participating in the Framingham Offspring Study. Men and women with the highest blood levels of phosphorus had just over 1.5 times of the risk of cardiovascular diseases, compared with people who had the lowest phosphorus levels.

Dhingra suggested several reasons for the negative effect of phosphorus. First, high phosphorus levels block the body’s production of vitamin D,

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Quick Reviews of Recent Research

• Low zinc boosts heart problems for diabetics

Finnish researchers analyzed blood levels of zinc and the risk of coronary heart disease among 1,050 middle-age patients with type-2 diabetes. Patients with low zinc levels were 30 percent more likely to have a fatal heart attack and 22 percent more likely to have a nonfatal heart attack, compared with people who had high zinc levels.

Soinio M, et al. *Diabetes Care*, 2007;30:523-528.

• Different types of carbs alter gene activity

Finnish researchers fed 47 overweight men and women breads and other starches made from of either rye grain or a combination of oat, wheat, and potato for 12 weeks. Rye triggers less of a post-meal diabetic-like insulin response, compared with the oat, wheat, and potato combination. Fiber intake was similar, and the starches provided at least 25 percent of the subjects' daily calories. The high insulin response of the oat, wheat, potato foods increased the activity of 62 genes related to stress and inflammation. In contrast, the rye foods decreased the activity of 71 genes. The researchers concluded that the choice of carbohydrates, apart of the number of calories and amount of fiber, may influence the risk of developing diabetes or heart disease.

Kallio P, et al. *American Journal of Clinical Nutrition*, 2007;85:1417-1427.

• Ginkgo reduces risk of death, but not dementia

French researchers investigated the risk of dementia and death among 3,534 seniors who took ginkgo or medications for memory impairment over 13 years. Ginkgo supplements did not modify the risk of dementia, but the use of drug treatments for memory products did increase the risk by about 35 percent. People who took ginkgo had a 24 percent lower risk of dying during the study.

Dartigues JR, et al. *Journal of the American Geriatrics Society*, 2007;55:395-399.

Phosphorus May Boost Heart Risk

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which may decrease heart function. Second, elevated phosphorus levels may directly injure blood vessel walls. Third, high phosphorus levels may be a sign of subclinical kidney disease, which is often associated with an increased risk of blood pressure and cardiovascular disease.

Reference: Dhingra R, Sullivan LM, Fox CS, et al. Relations of serum phosphorus and calcium levels to the incidence of cardiovascular disease in the community. *Archives of Internal Medicine*, 2007; 167:879-885. □

• Garlic supplements lower blood pressure

American researchers investigated the ability of garlic and other supplements to lower blood pressure. They focused on 25 young to middle-age subjects, six of whom had marginally elevated blood pressure. A combination of garlic tablets (2,500 mg) and vitamin C (2,000 mg) daily for 10 days normalized blood pressure in the six subjects with hypertension. Garlic alone reduced systolic blood pressure, while vitamin C alone had no effect. In addition, the combination of garlic and vitamin C increased nitric oxide production more than two-fold above the control subjects. Nitric oxide is the principal regulator of blood vessel tone.

Mousa AS, *Nutrition Research*, 2007;27:119-123.

• Pollutants may increase risk of type-2 diabetes

A team of researchers from Korea, the United States, and Norway analyzed levels of six persistent organic pollutants (POPs) in 2,016 adults and the risk of diabetes. The pollutants included PCBs, oxychlor-dane, trans-nonachlor, and three others. All six POPs were strongly associated with diabetes risk, particularly in overweight subjects. People with the highest blood levels of all six POPs were about 38 percent more likely to develop type-2 diabetes.

Lee DH, et al. *Diabetes Care*, 2006;29:1638-1644.

• Pollutants linked to prediabetes

In a follow-up study to the previous report, Korean, American, and Norwegian researchers investigated levels of persistent organic pollutants (POPs) and insulin resistance among 749 nondiabetic middle-age men and women. POPs include many widely used organochlorine pesticides and industrial pollutants. People with the highest blood levels of POPs, including oxychlor-dane, trans-nonachlor, and two polychlorinated biphenols (PCBs) were associated with a significantly greater degree of insulin resistance, a sign of prediabetes.

Lee DH, et al. *Diabetes Care*, 2007;30:622-628.

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