

Digestive Health, Functional Foods, and Micronutrients

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Diabetes is a chronic, progressive illness that requires continuing medical care and patient self-management to prevent acute complications and reduce the risk of long-term complications, such as cardiovascular disease, retinopathy, neuropathy and nephropathy. Evidence suggests that inflammation is the underlying cause of the long term complications resulting from uncontrolled diabetes. A diet high in antioxidant rich foods can help overcome inflammation in the body.

Nutrients in whole unprocessed plant foods control many functions in the body. At least four of the ten leading causes of death in the USA - diabetes, heart disease, stroke, and cancer - are directly related to what we eat. Virtually all health care providers intuitively realize that nutrition is the most important component and foundation of treatment for chronic conditions such as diabetes, obesity, and cardiovascular disease. The nutrients in food are our source of health. Foods contain various proportions of the macronutrients, carbohydrate, fat, and protein; water; various amounts of the well-known micronutrients, vitamins, minerals, fiber, and electrolytes; as well as several hundred naturally occurring substances in plant foods called **phytochemicals**. Evidence suggests that antioxidant supplements do not work as well as naturally occurring antioxidants in whole unprocessed foods such as fruits, vegetables, beans, legumes, nuts, seeds, whole grains, herbs and spices.



To control diabetes, we often focus on the macronutrients, carbohydrate, fat and protein, with little attention to the micronutrients which are so important for health. Health begins with digestion since digestive problems affect nutrient absorption and wellness in all areas of our lives. A stressed digestive tract is a primary source of inflammation. Allergies, food sensitivities, parasites, yeast overgrowth, and emotional stress can all inflame the GUT and affect nutrient absorption. It is very important to look at digestive health for overall health in diabetes.

Functional or Medicinal Food is any fresh or processed food claimed to have a health-promoting and/or disease-preventing property beyond the basic nutritional function of supplying nutrients. "Functional Foods" are foods or dietary components that may provide a health benefit beyond basic nutrition. Examples can include fruits and vegetables, whole grains, fortified or enhanced foods and beverages, and some dietary supplements. Biologically active components in functional foods may impart health benefits or desirable physiological effects. Functional attributes of many traditional foods are being discovered, while new food products are being developed with beneficial components. The American Dietetic Association (ADA) position statement defines functional foods to include "whole foods and fortified, enriched, or enhanced foods that have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis,



at effective levels.” As such, functional foods move beyond basic nutrition to provide additional health benefits that may reduce disease risk and/or promote optimal health. ADA strongly emphasizes that health claims on food products, including functional foods, be based on the significant scientific agreement standard of evidence.

Functional foods contain one or more of the following micronutrients: antioxidants- carotenoids, phytonutrients, phytoestrogens, isoflavons, lignins, omega-3 fatty acids, plant sterols and stanols, prebiotics and probiotics.

Examples of functional foods include fruits, vegetables, whole grains, beans and legumes, nuts and seeds, fish oils, fermented foods, fortified or enhanced foods and beverages, and some dietary supplements. Major categories of functional foods are:

1. **Antioxidants** are present in foods such as Vitamins, Minerals, Carotenoids, Flanonoids, isothiocynates, Phenols, Sulfides/thiols, and whole grains. Because oxidation is a naturally occurring process within the body, a balance of antioxidants must exist to maintain health. According to Ronald Prior, eating is stressful-in the process of breaking down and metabolizing foods, our bodies generate free radicals. Antioxidants obtained from food sources have synergistic effects on antioxidant activities, reduce disease risk, and can be beneficial to human health. Research indicates that dietary antioxidants are more effective than antioxidant supplements (Ceriello). There is evidence that hyperinsulinemia, with normal to near-normal glucose levels, may enhance free radical generation and contribute to oxidative stress.
2. **Omega-3 fatty acid LC-PUFAs** make up about 20 percent of the brain’s dry weight and are critical for healthy brain development and function. They provide benefits beyond reducing the risk of cardiovascular disease. Omega-3 fatty acids are beneficial at various stages of the lifecycle for: 1) Improved bone health; 2) healthy pregnancy outcomes; and 3) good visual acuity and cognitive development among infants.
3. **Probiotics and Prebiotics** are present in food, or can be incorporated into foods, and yield health benefits related to their interactions with the GIT. A probiotic is “a live microbial food ingredient that, when ingested in sufficient quantities, exerts health benefits.” Consumption of probiotics can help “balance” the flora, by increasing the number of helpful flora, and reducing or inhibiting the growth of harmful bacteria in the intestine. They can modify the gut immune response, improve its barrier function, and modulate or adjust the activity of the immune system, thus helping to control or reduce the development of certain allergies. Certain probiotic strains have been shown to have a favorable effect on markers of the immune response to stress. *Bifidobacteria* are the predominant bacterial species in the intestinal tracts of breastfed infants. The effects of probiotics are strain-specific.

4. **Prebiotics** are the “food” for beneficial bacteria, and are “non-digestible food ingredients that benefit the host by selectively stimulating the growth of one or a limited number of bacterial species in the colon, such as *Bifidobacteria* and *Lactobacilli*, which have the potential to improve host health.” Prebiotics in the diet enhance the effect of probiotic bacteria and have been shown to increase the absorption of certain minerals, such as calcium and magnesium. Preliminary studies suggest that prebiotics may have a favorable effect on the immune system and provide improved resistance against infection.
5. **Plant Sterols and Stanols are Phytosterols.** They are essential components of plant membranes that resemble the chemical structure of animal cholesterol and carry out similar cellular functions in plants. Sterols are naturally present in small quantities in many fruits, vegetables, nuts, seeds, cereals, legumes, vegetable oils, and other plant sources. Stanols occur in even smaller quantities in many of the same sources. Their benefits go beyond lowering blood cholesterol levels.

A vegetarian diet provides fiber, healthy fats, and phytonutrients, available only in plant foods. The American Dietetic Association is a strong advocate for vegetarian nutrition and affirms the adequacy of a vegetarian diet throughout the lifecycle.

All foods, both animal and plants, contain the macronutrients, carbohydrate, fat, and protein, vitamins, and minerals. However, only plant foods, including fruits, herbs, spices and especially vegetables, contain water, electrolytes and hundreds of phytochemicals.

It is impossible, at this time, to take the hundreds of phytochemicals, naturally present in plants made for their protection, and package them into pills for us to take as supplements. Hence it is important to consume a variety of colorful plant foods even if you take supplements.

Animal foods are pro-inflammatory, contain saturated fat and cholesterol, are calorie dense, and have no fiber or phytochemicals. Plant foods contain all the micronutrients, are nutrient dense, have low calorie density, and no saturated fat or cholesterol. The healthiest foods to eat, from the perspective of nutrient density are: Most vegetables, fruits, herbs and spices, whole grains, beans and legumes, nuts, and seeds. Plant foods are anti-inflammatory in nature, low in fat, and the fat they contain has no cholesterol or saturated fat.

Despite the recent popularity of high-fat, low carbohydrate diets (e.g. Atkins diet, South Beach diet) most health organizations including the American Heart Association, American Institute of Cancer Research, American Dietetic Association, American Diabetes Association, and the USDA, recommend increasing the intake of fiber from plant foods. Fiber is the indigestible part of plant cells. The usual sources are vegetables, fruits, whole grains, legumes, herbs, spices, nuts and seeds. There are soluble and insoluble fiber, and now a third kind called resistant starch. Fortunately, nature provides all three kinds of fiber, and by eating a variety of fruits, vegetables, whole grains, and legumes, it is possible to get adequate daily intake.

Research has shown that a low-fat vegan diet improves glycemic control and cardiovascular risk factors in a randomized clinical trial in individuals with type 2 diabetes. Strong evidence suggests

the quantity as well as the type of carbohydrate determine postprandial blood glucose levels. Whole plant foods containing fiber and resistant starch reduce hyperglycemia. Resistant starch is naturally found in common foods such as legumes, whole or partially milled grains, and just ripened bananas.

Soluble fiber feeds the intestinal bacteria, which produce short chain fatty acids (SCFA). SCFA have a number of positive effects on the body as they nourish the cells of the large intestine. Soluble fiber helps lower blood cholesterol. It is found in oatmeal, barley, and rye; beans, peas and lentils; fresh and dried fruits, and most vegetables.

Insoluble fiber aids in digestion by trapping water in the colon, and inactivates many intestinal toxins. It is present in the skins and seeds of fruits and vegetables, wheat bran, whole grains, and legumes.



Resistant starches are starches that escape digestion in the small intestine. Natural resistant starch is insoluble, and is fermented in the large intestine and is a prebiotic fiber. They provide some of the health benefits of both soluble and insoluble fiber, in addition to some unique advantages of its own. Colonic fermentation of indigestible carbohydrates may have the potential to regulate a patient's postprandial responses to the second-meal. Researchers say this result may be seen independent of the effect that fermentable carbohydrates have on a food's glycemic index. Fermentable carbohydrates may regulate postprandial responses by reducing nonesterified fatty acids' competition for glucose disposal. Resistant starch is found in whole grains, seeds, legumes, under-ripe fruit, and is especially prevalent in cooked starches that have been cooled - such as pasta salad, potato salad, and sushi rice.

Some human research has shown that a meal containing resistant starch causes a lower glycemic rise and insulin response in normal and overweight women, in people with impaired glucose tolerance, and in people with type 2 diabetes.

There are several intestinal, hormonal, and metabolic mechanisms by which dietary fiber could reduce food intake and promote weight reduction. Because fiber rich meals are low in energy density, their consumption may prolong feelings of satiety, and may reduce hunger and subsequent food intake.

Carbohydrate type may also influence glucose control. Diets richer in fiber, from whole plant foods, tend to produce lower postprandial blood glucose concentrations, compared with highly processed fiber-depleted diets. High-fiber diets have been shown to improve glycemic control in individuals with type 2 diabetes.

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Eat Right: American Dietetic Association www.eatright.org

Food for Life TV: <http://www.foodforlife.tv/>

International Food Information Council: <http://ific.org/>

Nutrition MD: <http://www.nutritionmd.org/index.html>

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PCRM Food for Life Resources for Diabetes: <http://www.pcrm.org/health/diabetes/>

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