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April 2011: Controlling Blood Sugar to Help Prevent Diabetes, Obesity, and Chronic Disease

Because a bagel, bran flakes, or a "Heart-Healthy" bowl of instant oatmeal is free of cholesterol and fat, we might think of these as a good way to start the day. But, when viewing foods with this lens, it can be easy to lose sight of the detrimental blood sugar effects of such fractured, concentrated carbohydrates. Ironically, these high-glycemic[1] foods can contribute to atherosclerosis and cardiovascular disease because excess blood sugar can damage cells, which means arteries, organs and other tissues.[2]

What I would like to offer in this newsletter and again in the next issue (which will illustrate blood sugar profiles of various foods) is a different way to think about meals. Instead of thinking primarily about calories or cholesterol, I hope you consider (if you do not already) how a meal or a snack affects your blood sugar. Reading and experimenting with blood sugar has taught me to view meals with this lens. Good health is not only about calories: If it were about calories, how in the last decade could obesity and diabetes rates skyrocket while the daily calorie intake of Americans did not increase?[3]

Why It Is Important to Control Blood Sugar: Obesity and Diabetes

Many chronic diseases are related to metabolic stress associated with elevated blood glucose levels. These diseases include *diabetes and insulin resistance; obesity; cardiovascular disease; hypoglycemia, overeating, depression, anxiety and mood swings; as well as some types of cancers*. Obesity and diabetes are clear and well-documented illustrations of the enormous increase in blood-sugar-related diseases. High-glycemic foods are linked to overeating, and hence obesity. High glycemic foods are also associated with insulin resistance and diabetes.

Obesity. Data from the National Center for Health Statistics (NCHS) indicate that one-third of all adults in the United States are *obese*. This rate has more than doubled (from 15% in 1979) in just 30 years. Because an equal one-third of all adults are *overweight*, fully *two-thirds of all adults in the United States*

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[1] On a scale of 0-100 with pure glucose as 100, the glycemic index (GI) of a plain bagel is 72; bran flakes, 74; and instant oatmeal, 82. Studies suggest that the body responds to oat porridge similarly to white bread: Liljeber, Granfeldt & Bjorck (1996), "Products based on a high fiber barley genotype, but not on common barley and oats, lower postprandial glucose and insulin responses in healthy humans." *American Institute of Nutrition,* 126, 458-466.

[2] Elson Haas, Staying Healthy With Nutrition, 178.
Side comment: With the expiration of Lipitor patents, we wonder if high-glycemic foods will be seen more and more as the cause of arterial damage, with cholesterol acting simply as the body's patching agent---are we blaming the band-aid for the underlying cut?

[3] Total calories per capita has not increased since 1965 nor in the past decade. Centers for Disease Control and Prevention (CDC), http://www.cdc.gov/nchs/data/databrief/db49.htm and http://www.cnpp.usda.gov/Publication/NutritionInsight/insight5.pdf

are either overweight or obese.[4] Obesity trends for children and teens are also discouraging. One in ten preschool children is currently *obese*, double the rate 30 years ago; while one of every five school-aged children (age 6-17) is obese, a rate that has tripled over the same 30-year period.[5]

Diabetes. Diabetes was not a major health factor 50 years ago. Fewer than 1% of all Americans were diabetic in the late 1950's. Today diabetes affects one out of every twelve Americans and one of four senior citizens. In addition, 25% of the population is sufficiently insulin-resistant to be classified as pre-diabetic.[6] These trends support the current projection that one-half of all Caucasian children and two-thirds of all children who are Black, Hispanic, and Asian-American born after the year 2000 will develop diabetes.

How Late-20th Century Food and Lifestyle Has Contributed to Blood-Sugar-Related Disease

No one single cause is, of course, behind the spread of metabolic stress and chronic disease. Among the constellation of dietary and lifestyle factors, the following are what I believe to be the major contributors:

- *The emphasis on low-fat, cholesterol-free foods.* Fats improve taste and satisfy hunger. But fats, especially traditional fats like butter, have lost dietary share to carbohydrates. Fats accounted for 45% of the American diet in 1965, compared to less than 33% today.[7] Butter consumption fell 66% over the last 100 years and 15% since 1970.[8] Yet, the milk fat in butter from grass-fed animals is associated with trimmer waistlines and lower rates of diabetes.[9] Butter from grass-fed animals is also the most reliable source of vitamin A since carotenes in fruits and vegetables can be difficult to convert to vitamin A.[10] It is true that excessive consumption of saturated fats from commercially-raised animals fed GMO corn can foster inflammation and diabetes, but butter from grass-fed animals has an ideal 1:1 ratio of omega-3:omega-6 fatty acids. Consuming modest amounts of traditional saturated fats as well as omega-3 fatty acids is important for healthy cell membranes and neurological function.

  Because low-fat foods do not effectively satisfy hunger, they can lead to overeating, particularly the overeating of carbohydrates. And, low-fat products affect metabolic stress a second way—

[4] http://www.infoplease.com/us/statistics/overweight-americans.html and http://www.cdc.gov/nchs/data/hestat/overweight/overwight_adult.htm
[5] http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.htm
[6] American Diabetes Association http://www.diabetes.org/diabetes-basics/diabetes-statistics/
[7] http://www.cnpp.usda.gov/Publication/NutritionInsights/insight5.pd
[8] Economic Research Service (ERS), USDA, "Dietary Assessment of Major Trends in U.S. Food Consumption, 1970-2005; March, 2008.
[9] Dairy fat (butter) is, along with red meat, essentially the only source of trans-palmitoleate, which studies show has a strong link to smaller waist measures and a reduced incidence of diabetes… http://wholehealthsource.blogspot.com/2010/12/dairy-fat-and-diabetes.html
[10] http://www.westonaprice.org/abcs-of-nutrition/167-vitamin-a-saga.html

food companies add extra sugars to low-fat foods to counter the loss of taste and satisfaction normally provided by fats. *Avoid low-fat processed foods because they will not satisfy you and they are loaded with extra sugars.*

- *Quality of carbohydrates.* Most carbohydrate calories consumed by Americans are from grains rather than from nutrient- and fiber-dense fruits and vegetables. Of the grains that are consumed, more than 90% are high-glycemic , refined-grain products.[11] Refining removes the fiber and phytic acid naturally found in whole grains—two factors that slow gastric emptying and therefore the blood glucose impact of starch metabolism. Thus, refined carbohydrates spike blood sugar, which can lead to hunger and overeating. *Emphasize whole grains and fruits and vegetables that are rich in fiber and antioxidants, rather than refined grain products.*
- *High-fructose corn syrup (HFCS).* The average American consumes 30 teaspoons of sugars and sweeteners/day, a figure equal to 477 calories, or about one-quarter of the total daily calorie intake based on a 2000-calorie diet.[12] HFCS began to creep into the American diet through processed foods and soft drinks 40 years ago. Since then, consumption of HFCS has grown 400%, replacing in many applications cane and beet sugars (consumption of these is down 38% since 1970). Exchanging HFCS for sugar exacerbates metabolic stress because HFCS is metabolized differently from sugar. It is even more harmful because, unlike sucrose that is metabolized by insulin and converted more readily into energy, HFCS is processed in the liver where it is converted into fat.[13] *Drink water rather than HFCS-sweetened soft drinks and read the labels of packaged foods.*
- *Quality of Fats.* Transfats are in many of today's packaged/processed foods. Transfats and refined vegetable oils foster obesity and diabetes because they upset biochemistry and cell membrane function, including insulin metabolism. While ingesting more transfats, consumers have shifted away from butter and coconut oil—fast-metabolizing short- and medium-chain fatty acids that provide a thermogenic effect to aid in weight loss[14]—in favor of refined vegetable oils that are slower to metabolize and more likely to be deposited as fat: Short- and medium-chain fatty acids like butter and coconut oil are attracted to water and transported through the intestinal wall to be quickly metabolized as energy. In contrast, vegetable oils with a longer 18-carbon chain must first be configured into triglycerides and carried by the blood stream to the liver, where they are more likely to be stored as fat.[15] *Avoid transfats and refined vegetable oils. These are inflammatory and disrupt metabolism. For satiety and to protect*

[11] Derived from data, ERS, USDA (2008).
[12] ERS, USDA (2008).
[13] S.S Elliott et al., "Fructose, weight gain, and the insulin resistance syndrome." *Am J Clin Nutr* 2002 Nov: 76 (5): 91.
[14] They are absorbed directly through the intestinal wall rather than needing to be carried by the blood stream to the liver. Butter is a 4-carbon short-chain fatty acid that is quickly burned as energy. Coconut oil is a medium-chain fatty acid that raises body temperature and the metabolic rate, burning more energy than it supplies. See Mary Enig, *Know Your Fats* and *Eat Fat, Lose Fat,* 61 & 109.
[15] Elson Haas, *Staying Healthy with Nutrition*, 74.

against diabetes, choose omega-3 fatty acids from fish and flax seed, as well as extra virgin olive oil, nuts, and nut/seed oils and modest amounts of butter from grass-fed animals.

- *Skipping Breakfast.* Over 40% of Americans aged 18-54 regularly skip breakfast, and more than half of all adults view breakfast as a mere mini-meal, snack, or simply a beverage.[16] Skipping, skimping and/or choosing a high-glycemic breakfast can lead to overeating and weight gain (see *Restoring Breakfast*, January, 2011). *Plan a delicious breakfast and make time for it. The thought of rewarding yourself with a good breakfast can encourage you to eat less the night before. A breakfast that includes a balance of all three macro-nutrients—proteins, fats, and carbohydrates—helps to stabilize blood sugar, an antidote to overeating.*
- *Lack of Investment in Food.* Our modern, urban lifestyle, supermarkets, and commercial farming have severed our former connection with food production. The time-consuming process and physical labor involved in raising animals, gardening/farming, preserving, and preparing foods naturally engenders a sense of gratitude, connection and conservation. Our ancestors ate sparingly the backyard chicken they called by name. We have no such connection to a commercial pizza or fast food. *What is inexpensive in both time and money is easy to over-consume.* Our lack of connection with food extends to our lack of investment in family meal hour: 66% of all Americans regularly eat dinner in front of the television.[17] *When possible, shop and prepare your own meals. It is the first step in knowing where your food comes from.*
- *Inactivity.* Hours spent watching television is one of the best barometers of inactivity. Except for sleep and yet with none of sleep's intrinsic benefits, nothing rivals TV as a depressant of metabolic rates and calorie burning. TV also engenders the "need" for junk food. *TV and assembly-line food make it easy to unconsciously surrender our autonomy, independence, and creativity.* The typical American child spends 1,500 hours a year watching TV, far more than the 900 hours spent annually in the classroom. TV's impact starts early, with preschoolers serving as a prime advertising target: An average 200 junk food, fast food, and toy ads are shown in the four hours of Saturday morning cartoons.[18] *To prevent "mindless" viewing that can lead to cravings for junk food and overeating, plan TV time—without a plan, it is easy to passively surrender to television.*
- *Supersizing.* We see this everyday: A bottle/can of Coke is taken today to be 12 or 20 ounces, but before 1955, Coke was sold only in bottles that were 6 ½ ounces in size. *If buying in bulk makes sense for economy, then try to use small plates; chew well; take time to truly enjoy your food; and be grateful—think of all the man-hours given by others to bring food to the table.*

General Strategies for Controlling Blood Sugar

The three general principles I believe to be the most important for controlling blood sugar are:

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[16] Lioger, et al., ...Insulin responses and satiety of healthy subjects. Journal of the American College of Nutrition, 28 (1), 30-36. And Ludwig, D.S, Majzoub, J.A., Al-Zahrani, A., Dallal, G.E,, Blanco, I, & Roberts, S.B. High-glycemic index foods, overeating, and obesity. *Pediatrics*, 102 (3), e26.

[17] http://csun.edu/science/health/docs/tv&health.html

[18] http://csun.edu/science/health/docs/tv&health.html

(1) *Plan meals to balance carbohydrates with adequate "healthy" proteins and fats (proteins and fats moderate the blood sugar impact of carbohydrates). A good balance is one-third of all calories in a meal from each of the three macronutrients—proteins, carbohydrates, and fats;*
(2) *Buy and consume whole, "real" nutrient-dense/antioxidant-rich, water-soluble/high-fiber plant foods—legumes, nuts, seeds, apples, and vegetables—the superior foods to control blood sugar;*
(3) *Take time for moderate aerobic and weight-bearing exercise to build the body's capacity to uptake blood sugar. Lift and move.* Lifting weights and some form of modest aerobic exercise can prevent insulin resistance and fat storage. This is because aerobic exercise makes the body more sensitive to insulin, while weight training builds muscle mass to take up blood glucose rather than having the body store this energy as fat. The average person loses 30 percent of their muscle cells by age 70, and this loss of muscle results in a slower metabolism, insulin resistance, increased body fat, reduced hormone production, and bone loss.[19] Lifting weights can prevent much of this attrition.

When we follow these simple concepts to control blood sugar, the rest often takes care of itself.

Specific Strategies for Controlling Blood Sugar

- *Plan to incorporate plant and animal proteins; nuts and seeds; olive, coconut, and flax oils; and low-glycemic fruits and vegetables* into carbohydrate meals. In combination, these provide fiber, antioxidants, and omega-3 fatty acids—which help protect against diabetes. Proteins and fats have a flat-to-negative glycemic index so they help ameliorate the metabolic impact of high-glycemic foods. They are the most efficient way to reduce the glycemic impact of carbohydrates (fruits and vegetables contain carbohydrates so they are not effective as effective buffers to high-glycemic carbohydrates). Avoid *excessive* amounts of protein, however, which can depress metabolism.[20] Consuming great quantities of fats and proteins can lead to insulin resistance.
- *Use tart (not sweet varieties, e.g., balsamic) vinegar in meals to* lower the blood sugar impact of carbohydrates. Think dressed green salads or pickles on sandwiches as alternate ways to incorporate vinegar into a meal. Tart vinegar can lower the glycemic index of a meal by some 33%.[21]
- *Add whole grains when baking* with flour or cooking with fractured grains. This will lower the glycemic effect and add crunch and interest. Note: *Regular whole wheat flour (if not stone-ground), while delivering more nutrition than white flour, has an equivalent GI because it is ground to the same fine particle size as white flour.*[22] Grains must be whole,

[19] J.E. Williams, *Prolonging Health,* 68.
[20] Broda Barnes, *Hope for Hypoglycemia,* 33. In a personal experiment, Broda Barnes tried two separate diets—a high-protein and then a high-fat diet. On the high-protein diet (100 grams/day) with low carbohydrate and fat, he had to restrict his daily calorie intake to 2000/day to avoid gaining weight. In contrast, on a high-fat diet (100 grams/day with only 60 grams of protein), he could eat 3000 calories/day while maintaining a stable weight.
[21] H G Lijeberg & I Bjorck (1998). Delayed gastric emptying rate may explain improved glycaemia in healthy subjects to a starchy meal with added vinegar. European Journal of Clinical Nutrition, 52 (5): 368-71.
[22] Snow, P. & O'Dea, K. (1981). Factors affecting the rate of hydrolysis of starch in food.

not refined—only when the outer bran husk is intact can this natural protection buffer the inner starch from enzymatic activity to slow the conversion of starch to glucose.

- *Bake with stone-ground flour* rather than commercial flours that are milled at high temperatures. Stone-ground flour preserves amylase inhibitors for a lower GI.[23]
- *If you can, consider adding sourdough when baking. If not, when shopping choose traditional sourdough made without commercial yeast.* The yeasts and bacteria in sourdough consume some of the bread flour's carbohydrate, reducing the glycemic effect by roughly one-third compared to yeasted bread.[24]
- *When soaking grains to reduce phytates, try to consume them with a fat or protein to reduce the glycemic effect. (Soaking reduces phytic acid,* a mineral inhibitor, but soaking before cooking also raises the glycemic index.
- *Eat foods rich in chromium.* Chromium is a core component of glucose tolerance factor (GTF) that regulates carbohydrate metabolism and proper insulin function to support healthy blood glucose levels. Chromium is widely recognized in the treatment of diabetes and hypoglycemia, but it is also important in the prevention of atherosclerosis and cardiovascular disease because of the damage to arteries brought about by high blood sugar. Chromium levels decrease with age, with depleted soil conditions, and with the modern diet weighted to refined grains. Due to our diet of sugars and refined flour and the low levels of chromium in our soil, one-quarter to one-half of all Americans are deficient in chromium, the highest rate of any country. *Food sources of chromium include: brewer's yeast, beef, liver, whole wheat, rye, oysters, onion, potatoes, tomatoes, wheat germ, eggs, chicken, apples, butter, bananas, and spinach.[25] Magnesium and vanadium are also important minerals for proper insulin function.*
- *Cook with herbs and spices* to help control blood sugar—those that increase insulin sensitivity (*caper, cinnamon, fenugreek, ginger);* mimic insulin (*caper, coriander, garlic*); and encourage insulin production (*coriander*). [26] Other helpful herbs and spices include *sage, rosemary, marjoram, tarragon, cloves, allspice,[27] cayenne, and turmeric*. All perform different functions so it is best to use a combination. If you choose only one, think cinnamon. *Cinnamon,* which is rich in phenols, lowers blood sugar in three ways: by delaying gastric emptying; enhancing insulin sensitivity; and increasing antioxidant defenses.[28] One daily gram of cinnamon can reduce the blood glucose of diabetics by 30%.[29]

American Journal of Clinical Nutrition, 34 (12), 2721-2727.

[23] Snow, P. & O'Dea, K. (1981).

[24] HG Liljeberg, Lonner & Bjorck (1995). Sourdough fermentation or addition of organic acids or corresponding salts to bread improves nutritional properties of starch in healthy humans. *Journal a Nutrition,* 125 (6):1503-11.

[25] Elson Haas, *Staying Healthy with Nutrition.*

[26] http://www.medicinal-herbs-and-spices.com/herbs-for-diabetes.html

[27] R.P. Dearlove, et al., Inhibition of protein glycation by extracts of culinary herbs and spices. *Journal of Medicinal Food,* 11 (2) 2008, 275-281.

[28] RP Dearlove, et al. (2008).

[29] http://www.medicinal-herbs-and-spices.com/herbs-for-diabetes.html

- *Be aware that particle size, the degree of cooking, the ripeness and the specific variety of a food, and the temperature of a meal when consumed affect the glycemic index and metabolic effect of foods.*
- *Eat pizza sparingly.* Pizza elevates blood sugar longer than almost any other food. While the exact reasons are not clear, research indicates that a pizza meal causes blood sugar to continue to rise and remain elevated from four to nine hours after eating—far more than a high-glycemic control test meal of equivalent macronutrient composition.[30]
- *Take care with alcohol.* Alcohol has no carbohydrates so it does not appear on GI listings—its GI=0. However, alcohol provides 7 empty calories per ounce, almost twice the 4 calories an ounce of proteins and carbohydrates. Because the body burns calories from alcohol before it uses those from proteins, fats, and carbohydrates, consuming alcohol with a meal means that more food-derived calories are likely to be stored of fat. Alcohol, by clouding judgment and setting up craving for carbohydrates and rich foods, can also lead to overeating. The University of California, Berkeley [Wellness Letter, August 2004] sees an additional risk: "Under certain circumstances, alcohol can actually cause a low blood sugar reaction…when the body wants to release stored glycogen (sugar) to combat low blood sugar levels, alcohol prevents it from doing so." On a positive note, some studies suggest that moderate alcohol consumption can enhance insulin sensitivity in diabetic subjects.[31] In sum, drinking beyond a moderate level is not a good practice for controlling blood sugar.

A Final Comment—Genetics and the Importance of Diet and Lifestyle to Prevent Diabetes and Obesity

Native Americans, African Americans, Hispanic Americans, and Asian Americans have a greater genetic tendency to develop type-2 diabetes, but diet and lifestyle factors are a potent way to override this genetic bias: studies suggest that lifestyle changes can reduce the genetic risk of diabetes by 58%.[32]

The Pima Indians are a case in point: The Pimas of Arizona have the highest rate of diabetes and obesity of any group worldwide. They, like many Americans, consume convenience foods and live a relatively sedentary lifestyle. In contrast, the Pima Indians in Mexico rarely suffer from diabetes or obesity—they weigh on average 60 pounds less than the Pimas of Arizona. To subsist, the Pimas of Mexico who are not exposed to modern conveniences must carry water long distances and grow and prepare their own food. Their active lifestyle and diet appears to prevent their genetic tendency of diabetes from expressing itself. Several large sample-size scientific studies also point to the effectiveness of dietary and lifestyle change, suggesting that these are twice as effective as drugs to reduce the risk of diabetes, and with none of the serious side effects associated with drug treatment.

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[30] J. A. Ahern, et al., "Exaggerated hyperglycemia after a pizza meal in well-controlled diabetics." *Diabetes Care,* Vol. 16, April 1993, 578-580.
[31] AE Bantle, et al. (2008). Metabolic effects of alcohol in the form of wine in persons with type 2 diabetes mellitus. *Metabolism.* Feb; 57 (2): 241-5.
[32] Pizzorno and Murray, Textbook of Natural Medicine, 1614-6

Recipes for Controlling Blood Sugar:

Raw Rolled Oat Banana Cookies

Rolled oats are metabolized at less than a third the rate of cooked oat porridge (Snow and O'Dea, 1981). The use of raw oats, banana as the sweetening agent, and nuts all contribute to a cookie that is delicious, yet relatively low on the glycemic scale.

3 ripe bananas
2 cups old-fashioned rolled oats
1 cup dried fruits such as cranberries or raisins
1 cup chopped nuts (optional)
1 teaspoon cinnamon, or to taste
1 teaspoon vanilla, or to taste

Preheat the oven to 350 degrees. In a large bowl, mash the bananas, then add the other ingredients and mix. Drop by spoonfuls onto an ungreased cookie sheet. Bake for about 20 minutes.

Wild Rice Muffins—*an example of adding whole grains to baked goods.*

1 cup cooked wild rice
2 eggs, lightly beaten
5 T. melted butter, coconut oil, or oil of your choosing
1 cup milk
1 ¼ cup whole wheat pastry flour
1 T. baking powder
2 T. sugar

1. Preheat oven to 425 degrees. Grease a 12-muffin tin.
2. Stir the wild rice together with the egg, oil, and milk in a mixing bowl.
3. Combine the flour, baking powder, salt, and sugar in another bowl. Stir until well mixed.
4. Stir the dry ingredients into the liquid ingredients, gradually and thoroughly, until blended.
5. Spoon the batter into the muffin cups. Bake 15-18 minutes, until lightly browned.

Cinnamon Stick Stewed Fruits

This is a simple favorite of my family. Cinnamon-stewed fruits are a regular standby in our refrigerator. Combine with cooked cereals, custards, topped with nuts, or eaten alone. The cinnamon, a powerful antibacterial and antioxidant, can significantly reduce the glycemic effect of foods (discussed above).

4 large, 4" cinnamon sticks, or the equivalent
1 pound each pitted dried prunes, Turkish apricots, and dried organic apples, washed well.

In a large sauce pan, place cinnamon sticks and the dried fruits. Cover with water. Bring to a boil, simmer 5 minutes, cover, and let set until cool. Refrigerate. Cinnamon helps preserve fruit for days. The stewed fruits and juice become more delicious and seasoned with time.