

## Carbohydrates, The Metabolic Syndrome, Hb A1c, And The Glycemic Index Of Food

### **Sugars, And Carbohydrates**

Sugars are carbohydrates. Sugars are carbohydrates with a strong sweet taste. Glucose is such a carbohydrate. Glucose is also the sugar found in our blood. Physicians use the word "hyperglycemia" when the level of sugar in the blood circulation is high. (Hyper = high and glycemic = glucose in blood.) The word "Hypoglycemia" defines the opposite situation where the level of glucose in the blood circulation is low (Hypo = low). There are other carbohydrates with a lesser sweet taste than sugar and some carbohydrates have no sweet taste at all. Their presence in food is *undetectable by taste*. Sugar (made of glucose and fructose) and starch (made of glucose) eventually end up as glucose in our blood after a short or longer process involving the digestion and the absorption in the intestine. They trigger a moderate or a sustained surge of the blood glucose level. A large amount triggers a strong surge of blood glucose level.

### **The Insulin Response**

The pancreas gland monitors the blood glucose level. The pancreas gland produces the hormones insulin and glucagon and releases them accordingly the variations of the level of glucose in the blood circulation. Insulin lowers the level of circulating glucose and more of it is released each time the glucose level surges. Insulin lowers the blood glucose level by pushing glucose into the cells. Glucagon restores a crumbling glucose blood level by releasing stored glucose. If we eat much sugar and starch, the jump of the glucose blood level triggers a fierce reaction of insulin release by the pancreas. Hypoglycemia may follow with its symptoms of anger, irritability, impulsiveness, and severe craving for sweet and it all starts again.

### **Carbohydrates Excess In The American Diet**

The American diet is too rich in sugar and starch. Starch is the carbohydrate found in grain, in potatoes. For more information on carbohydrates, please see Newsletter 8 in the Longevity Institute website at <<http://www.longevinst.org>>. With too much sugar and too much starch in the diet, the blood glucose level tends to stay high. The consequences of a constant high blood glucose level have only recently unfolded. It has become evident a constant glucose overload is damaging by itself and by the insulin overload it triggers and maintains.

### **Damage by Carbohydrate Overload**

Carbohydrates have other functions in our biochemistry than only to supply energy. Carbohydrates are also parts of complex molecules, as the molecule embedded in the cell membrane that assume cell recognition and communication. When cells attach carbohydrates to proteins to make complex molecules, they attach the carbohydrate at a specific site of the molecule and on a specific molecule for a specific purpose only. In contrast, carbohydrates (mainly glucose and fructose) can also haphazardly attach to any of several sites along any available protein or other molecule. This happens more when the level of circulating carbohydrates remains high. The random attachment of carbohydrates to proteins and other molecules triggers a cascade of chemical reactions that culminate in the formation, and eventual accumulation, of irreversible cross links between adjacent molecules (Amadori products). *The linked molecules lose their mobility and function. The consequences affect all organs, brain included.* Red blood cells exposed to a high carbohydrate level have their hemoglobin altered by the binding of the carbohydrate. Bound hemoglobin is said glycosylated (or glycated) hemoglobin (Hb A1c). A Hb A1c level of 5 to 6 is considered acceptable, 3 or 4 is better. The Hb A1c level reflects the overall damage of a carbohydrate excess.

### **Damage By Insulin Overload**

Another aspect of a sustained high glucose level in circulating blood is the insulin overload it triggers and maintains; A - A higher insulin release tends to push glucose in the cells beyond cells' capacity. To defend themselves cells down regulate the activity and the number of their insulin receptors. Cells become insulin resistant.

B - The pancreas—monitoring the glucose blood level, *not the level of glucose in the cells*—continue to release more insulin, which increases cell's insulin resistance. The resulting constant high glucose and high insulin level create disturbances in several cells and organ functions. The condition is named "Metabolic Syndrome"

C - With time diabetes may appear.

### Metabolic Syndrome

Metabolic Syndrome contribute to cardiovascular disease, hypertension, obesity, stroke, cognitive disorders, depression, worsening of many other conditions (like arthritis), exaggerated immune response resulting in a multitude of other ailments. Metabolic syndrome is also the precursor of diabetes. Definition of the Metabolic Syndrome At least three of these: 1 - Abdominal obesity. 2 - A blood pressure greater or equal to 130/85 . 3 - A fasting glucose level greater than 110 milligrams per deciliter. 4 - A serum triglycerides level higher than 150 milligrams per deciliter. 5 - A serum HDL level lower than 40 milligrams per deciliter.

### The Glycemic Index Of Food

The glycemic index—a system of ranking carbohydrates and the foods that contain carbohydrates according to how fast they affect blood sugar levels—started out years ago as a dietary tool for people with diabetes. Now the GI concept has spread as a way to evaluate carbohydrates for people who are not (yet) diabetic. High-GI carbohydrates (to be avoided) include processed breads, most cereals, potatoes, short-grain white rice, and some fruits. Low-GI carbohydrates (fine to eat) include whole grains, brown rice, pastas, legumes, sweet potatoes, oats, and some fruit. (See table 1, page 2 for more).

### List of some foods with their Glycemic Index

A Glycemic Index (GI) is low if under 55 (green in the table), high if greater than 70 (red).

|               |    |                    |    |                   |     |
|---------------|----|--------------------|----|-------------------|-----|
| <b>BEANS</b>  |    | <b>COOCKIES</b>    |    | <b>VEGETABLES</b> |     |
| Soy           | 18 | Oatmeal            | 55 | Sweet Potato      | 54  |
| Soy           | 22 | Shortbread         | 64 | Beets             | 64  |
| Kidney        | 27 | Graham Crackers    | 74 | Carrot            | 65  |
| Red Lentils   | 27 | Vanilla Wafers     | 77 | Ruitabaga         | 72  |
| Black         | 30 |                    |    | Potato            | 92  |
| Butter        | 31 | <b>CRACKERS</b>    |    | Parsnips          | 97  |
| Split Peas    | 32 | Rye                | 63 |                   |     |
| Brown         | 38 | Stoned Wheat       | 67 | <b>MILK</b>       |     |
| Navy          | 38 | Saltine            | 72 | Whole             | 27  |
| Pinto         | 42 | Rice Cakes         | 82 | Soy               | 31  |
|               |    |                    |    | Skimmed           | 32  |
| <b>DRINKS</b> |    | <b>PASTAS</b>      |    | Yogurt            | 33  |
| Apple Juice   | 23 | Spaghetti enriched | 28 | Ice Dream         | 60  |
| Tomato        | 39 | Vermicelli         | 35 |                   |     |
| Oreng Juice   | 44 | Spaghetti          | 40 | <b>FRUITS</b>     |     |
| Cranberrie    | 54 | Linguine           | 50 | Grapefruit        | 25  |
| Coca-Cala     | 63 | Cheese             | 64 | Strawberries      | 32  |
| Sport Drinks  | 70 | Macaroni           | 80 | Apple             | 32  |
|               |    | Brown Rice         | 92 | Pear              | 36  |
| <b>BREADS</b> |    |                    |    | Peach             | 42  |
| Barley        | 48 | <b>CEREALS</b>     |    | Orange            | 43  |
| Rye, whole    | 50 | Oatmeal            | 49 | Kiwi              | 52  |
| Multigrain    | 54 | Frosted Flakes     | 55 | Apricot           | 55  |
| Muffins       | 60 | Oatmeal Minute     | 66 | Banana            | 56  |
| Croissant     | 66 | Shredded Wheat     | 69 | Papaya            | 58  |
| Rice          | 73 | Cheerios           | 74 | Raisin            | 64  |
| Waffles       | 75 | Corn Bran          | 75 | Cherries          | 72  |
| White         | 85 | Rice Krispies      | 82 | Dates dried       | 100 |
| Baquette      | 95 | Corn Flakkes       | 83 |                   |     |
|               |    | Puffed Rice        | 90 |                   |     |

Table 1 - List of food with its (glucose scale) Glycemic Index \* In Australia  
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For more information, see the comprehensive list of Glycemic Index of food published by Rick Mendosa at:

<http://diabetes.about.com/library/mendosagi/ngilists.htm>

Both GI and Glycemic Load (GL) of foods are listed there.

The GI of foods based on the glucose index—where glucose is set to equal 100. The GL is the glycemic index divided by 100 multiplied by the available carbohydrate

content (i.e. carbohydrates minus fiber) of food in grams.

Do your own research: To find the GI of (almost) any food go to the web site of the University of Sydney: <http://ziag4.mmb.usyd.edu.au>, and enter a food name in the query box.