Control of Sugar Metabolism:

Manifesto for a New Approach to Diet and Weight Control

Clair A. Francomano, M.D.

Associate Professor of Medicine
Johns Hopkins University School of Medicine

Director of Genetics
Director of Cephalic Research
Glycemic Research Laboratories

Chief of Genetics
Skinny Science Research

Director, Adult Genetics
Harvey Institute for Human Genetics
Greater Baltimore Medical Center

Nutritional approaches to weight management have varied widely over the past 50 years.

Low caloric diets were supplanted by low-fat and fat free products; the Atkins craze advocated very low carbohydrate consumption; corporations such as Weight Watchers, Jenny Craig and LA Weight Loss have emerged to market their advice and products to desperate overweight consumers.

Yet the one constant over the last half-century has been a steady increase in the rates of obesity among both the adult and pediatric populations in the United States and throughout the industrialized world.

A set of maps from the *United States Centers for Disease Control* (CDC) tell the alarming tale since 1986: In 2007, only one state (Colorado) had a prevalence of obesity less than 20%.

Thirty states had a prevalence equal to or greater than 25%; three of these states (Alabama, Mississippi and Tennessee) had a prevalence of obesity equal to or greater than 30%.

For a dramatic illustration of these statistics, see:

http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/

LOWERED LIFE SPAN PREDICTED

We know well that an increase in obesity rates predicts a corollary increase in rates of hypertension, diabetes, heart disease and even some forms of malignancy.

Epidemiologists are now predicting that children in the current generation are likely to have a *lower life expectancy* than that of their parents, precisely because of the burgeoning rates of obesity in the pediatric population. This is a public health trend of desperate proportions, and there is great urgency to finding and implementing new strategies to tackle the problem.

Over the past several years, evidence has begun to emerge that the regulation of sugar metabolism is a rational starting point for designing such strategies. We know that the human body has evolved over millennia to survive in times of famine, and that evolutionary strategy includes the biochemical machinery for storage of excess calories in the form of adipose tissue during times when the food supply is abundant.

Unfortunately, our evolutionary machinery has not caught up with the industrialization of the food supply over the last century. Our bodies are still storing excess calories in the form of adipose tissue, but for the population alive today in the industrialized world, food

has been in great abundance and readily available at fast-food restaurants and convenience products at the grocery store. We were designed by evolution to thrive in a feast-or-famine world; our bodies are not equipped to deal with feast-and-feast.

EVOLUTIONARY DISCORDANCE

There are two primary mechanisms whereby the human body stores excess calories, and both of them involve sugar metabolism and the production of the hormone insulin by the pancreas. One is the direct elevation of blood sugar by ingested food and the response of the pancreas to secrete insulin into the blood stream.

Insulin acts as a key to the adipose tissue fat cell, unlocking that cell to allow the entry of excess calories in the form of lipoproteins. This direct response is responsible for the dire metabolic consequences of ingestion of foods high in sugars, or those that are rapidly converted into simple sugars in the blood stream. This group of foods is high on the glycemic index, and stimulate the production of a large amount of insulin and its metabolic side-kick, lipoprotein lipase.

Low glycemic foods do not result in a rapid rise of simple sugars in the blood stream and hence result in a more moderate, or even absent, pancreatic response. Insulin and Lipoprotein Lipase (LPL) secretion in response to such meals is minimal, and fat storage is avoided.

There is another mechanism whereby fat storage is stimulated in the body. When we taste a food, or a nutritional supplement or a chemical that tastes *sweet*, the brain immediately engages the biochemical apparatus of the body to get ready for anticipated carbohydrate consumption.

Before any sugar molecules are actually absorbed into the blood stream, the brain is sending the message to the pancreas to secrete insulin. Thus, the body will be set up for fat storage, even if the sweet taste is caused by an artificial sweetener with few calories attached.

This is a diabolical consequence, because the secreted insulin drives down the circulating blood sugar and drives up the hunger signals, causing the person to crave more calories.

CEPHALIC BRAIN RESPONSE

This so-called "*Cephalic Response*" is at the basis of recent scientific reports and discussions in the public media about the negative consequences of consuming dietary beverages; paradoxically, beverages sweetened with artificial sweeteners may actually cause more weight gain than those sweetened with sugar, due to the intensity of the cephalic brain response invoked by the artificial sweeteners.

Evolution has developed another set of responses that work against humans in the current environment as well. Humans have developed a high degree of preference for sweet foods, in part to assist in the storage of excess calories when food is abundant.

Thus, the consumption of sweets is closely connected to the reward centers in the brain where pleasure is recognized. In experimental studies, animals offered a choice of sweetened or unsweetened chow or beverages will always choose the sweet option, and will consume many more calories of that option if they are allowed to eat or drink *ad libitum*. The preference for sweet taste is hard-wired into our brains, and is one of the major reasons that decades of dietary interventions have been largely unsuccessful.

Hence, a new approach is needed. This new approach must take our evolutionary past into consideration and recognize three very important truths:

1. People are going to continue to crave sweets.
2. The human body will respond to the ingestion of high glycemic foods and beverages with secretion of insulin, resulting in fat storage through the lipoprotein lipase mechanism.
3. Many synthetic sweeteners currently on the market also stimulate the cephalic response, resulting in secretion of insulin and fat storage even though they do not have associated carbohydrate calories.

GROUNDBREAKING SCIENCE:
LOW GLYCEMIC, NON-CEPHALIC TECHNOLOGY

Novel natural fruit glycoside sweeteners termed *"Sweet Infused Fruits"*, as developed by the noted biochemical researcher and inventor Dr. Ann de Wees Allen, are a highly promising alternative to High Glycemic sweeteners such as high fructose corn syrup and High Cephalic sweeteners.

As demonstrated in multiple in vivo human clinical trials, products such as ice cream, chocolate and candies sweetened with *"Sweet Infused Fruits"* do not raise circulating blood sugar levels and do not stimulate the secretion of insulin or lipoprotein lipase.

In fact, such products have been shown to possess so-called "anti-carbohydrate" properties, protecting the body against the rise in sugar, insulin and lipoprotein lipase that would be expected to occur if a high-glycemic food is consumed after they have been ingested.

As an additional benefit, foods and beverages sweetened by these natural fruit glycosides to do not evoke the cephalic response, and so the sweet taste they offer does not result in the secretion of insulin mediated through the brain.

Thus, Dr. Allen has presented the world with an opportunity to meet the demands of our evolutionary mandate for sweet foods and beverages without sending us down the road to a future in which we are destined to develop obesity and the many co-morbidities with which it is associated.

CONCLUSIONS

The development of foods and beverages naturally sweetened by "*Sweet Infused Fruits*" has the potential to enable people to control their evolutionarily mandated cravings and get control over their weight over the long term.

These products represent a unique opportunity to intervene on the public health emergency represented by the ongoing obesity epidemic.