Sugar, Glycation and Risk

On 21 May 2012 the on-line journal Pediatrics released a summary of the NHANES study showing a shocking risk of Cardiovascular Disease and Diabetes in teenagers. The incidence of Diabetes and Prediabetes increased from 9% in 1999 to 23% in 2008. We face a tsunami of preventable disease. Glycaemic Index and glycation are two concepts that can help our children and ourselves reverse and prevent a physical death spiral.

The NHANES study

This long-standing study (National Health and Nutrition Examination Study) analysed data on 3383 adolescents between 12 and 19 years of age between 1999 and 2008. The findings were:

- Increase in diabetes and pre-diabetes: 9 to 23%
- Number of teens with at least one CVD RF*
  - 37% normal weight teens
  - 49% of overweight teens
  - 61% of obese teens
- Prevalence of high blood pressure = 14%
- Prevalence of high LDL chol = 22%
- Prevalence of low HDL chol = 6%
- Obesity rates steady at 16-18%

*CVD RF: cardiovascular disease risk factor

The study reported that *"CVD risk factors are often present during childhood and adolescence, but the "overt manifestations," of these risk factors, such as heart attack and stroke, do not usually emerge until adulthood."*

As a parent of two teenagers this is alarming. Please join me in reversing this critical risk.

Increasing evidence and opinion is that our high glycaemic diet is strongly correlated with both diabetes and cardiovascular disease. Reducing our glycaemic index and load is one practical approach to beating the upcoming burden of disease.

Global Diabetes risk (WHO data)

- 346 million people live with diabetes
- Diabetes increasing fast
- Deaths to increase by 50% in next 10 years
- 85-95% of diabetes is Type 2
- 80% of Type 2 is preventable by lifestyle
- 2010 treatment cost is $418 billion
- Indirect costs amount to trillions

Terminology & issues

Type 1 Diabetes (10% of cases) is caused by reduced insulin production. It occurs in younger years and requires the administration of insulin along with carefully managed lifestyle.

Type 2 Diabetes (90% of cases) is largely provoked through weight gain, reduced exercise and poor diet. Many genes are linked, some of which are "switched on" by poor lifestyles. The treatment is lifestyle change – activity and low GI nutrition.

Gestational Diabetes is where pregnancy causes a temporary manifestation of diabetes.

Type 3 Diabetes refers to early evidence that poor insulin availability in the brain interferes with memory and Dementia (including Alzheimer's). It is clearly linked to type 2 diabetes.

Pre-diabetes or **Insulin Resistance** describes the physiological changes leading up to a diagnosis of diabetes. Diagnosis is on fasting blood glucose between 5.6 and 6.9 mmol/l (ADA). Excess availability of blood glucose pushes insulin production up. The cells then begin to 'resist' insulin's effect on absorbing glucose. Raised insulin and HbA1c are also higher.

Metabolic Syndrome describes a combination of

factors including insulin resistance, high blood pressure, high triglyceride, low HDL, abdominal obesity and high uric acid. This common combination frequently leads to diabetes and CVD disease such as heart attacks and stroke.

Glycaemic Index (GI) refers to the rate at which glucose is released from food. Excess high GI foods increase risks for diabetes, weight gain, CVD and metabolic changes of ageing (see table).

Glycaemic Load refers to the amount of glucose held in a food. For example a potato/coke has a very high load and a lettuce/carrot a low load.

Glycation (or **glycosylation**) is a reaction between sugar, and fat or protein. Glycation can happen outside the body as in barbecued meat, donuts, cake and dark coloured soda. It can be described as caramelisation. The Advanced Glycation Endproducts (AGEs) produced are implicated in inflammation and disease including diabetes, cardiovascular disease, metabolic syndrome and many chronic diseases of age.

Glycation inside the body occurs when glucose reacts with proteins and fats also causing AGE production. They have been implicated in cardiovasucular disease, Alzheimer's, cancer, neuropathy and accelerated oxidation. Fructose is particularly active in causing internal glycation. This is one reason many worry about high fructose corn syrup, which is replacing sucrose in our food.

Glycation: The simple story

Let's explore how sugars in our food act in the body, and how this can lead to metabolic problems, glycation, diabetes, chronic preventable disease and premature ageing.

Humans enjoy sweetness. Sweetness indicates energy sources important in our evolution. The more sweetness in a food, the more we desire it and purchase it. Consequently the consumption of sugars has increased dramatically. With decreasing activity levels, we simply have too much available sugar in our diets and blood stream. Processed foods tend to be high in both available sugars and fructose. Their release into blood is fast – thus high glycaemic index.

We also enjoy browning (caramelisation). Food manufacturers and outlets have been quick to capitalise on this desire with a massive increase in AGEs in our food over the past 50 years. Infant formula milk contains a 100 times more AGEs than human or cow milk.

Firstly, this challenges our insulin and glucose storage leading to insulin resistance, weight gain and the production of excessive AGEs. In addition, AGE's in what we eat lead to a massive load in AGEs and the consequent metabolic impairment.

Initially, inflammation increases and then glucose levels start to rise. We progress from metabolic syndrome to pre-diabetes, and on to diabetes. The combination promotes cardiovascular disease, Alzheimer's, cancer and many diseases of ageing.

Of course there are many variations to the story but the bottom line is that we must resist, with wisdom, the disease spiral related to excess, high GI carbohydrate (internal glycation) and excess consumption of AGEs.

Remember, not all processed food is bad!

Reducing AGE consumption

- Fats and meat products contain the most AGEs
- Carbohydrates are relatively low in AGEs
- Higher cooking temperatures increase AGEs
- Longer cooking times increase AGEs
- The presence of liquids in cooking reduces AGEs
- Fruits and vegetables are very low in AGEs
- Processed foods have more AGEs than natural or homemade foods

We have much to learn yet about AGEs and their

effect on our bodies and minds.

Glycaemic Index

The table below summarises the glycaemic index of some foods. The data comes from Professor Jenny Brand-Miller from Sydney, a well-respected source. The University of New South Wales allows you to check on most foods at **www.glycemicindex.com** . It is continuously updated so please check your foods. Below the table are some suggestions.

Understanding and using the Glycaemic Index

The glycaemic index is a measure of how quickly a food releases sugar (glucose) into your blood stream. The GI measure is only relevant for foods with carbohydrate.

Glycaemic load refers to the amount of carbohydrate in a food. It is independent of glycaemic index but must be considered. For example; potatoes have high index and high load, carrots have low load and index and oat porridge has high load but low index.

High GI foods such as white bread	Low GI foods such as beans or lentils
Release Glucose quickly	Release Glucose slowly
Increase insulin and risk of diabetes	Reduce insulin and risk of diabetes
Are not filling and risk weight gain	Are filling and facilitate weight loss
Raise lipids and heart disease risk	Improve cholesterol and half CVD risk
Accelerate ageing and cancer risk	Slow ageing and protect from cancer

Quick wins to reduce glycation and diabetes risk:

Remember that proteins and fats do not release glucose and will lower GI when added to your meal. Enjoy:

Switch from risky, High GI choices:	To smarter low GI Choices:
White bread, cookies and muffins	Whole grain bread, sourdough
Processed cereals (often boxed)	Rolled oats, muesli or porridge
Chips and packaged snacks	Fresh or dried fruit, vegetables or nuts
Soft drinks	Smoothie, coffee, tea, water
French fries are very bad news	Salads, vegetables,corn
Candy, sweets and mints	Dark Chocolate (70%), nuts, dried fruit
Potatoes and rice	legumes, veggies, Basmati or long grain rice
Sugar	Honey or fruit

- Fish, eggs, poultry and lean meats
- Chickpeas, lentils, beans
- Milk or yogurt
- Olive oil, avocado and nuts (mono-unsatuarted oils)

Please remember that Glycaemic Index is one important principle in your nutrition. Equally important are:

- Increasing your vegetable and fruit intake
- Regular, small meals and a big breakfast
- Reducing salt, vegetable oils, and excess processing of foods
- Enjoying the good fats such as fish oil, flaxseed oil and olive oil

Note for Athletes:

High glycaemic foods before exercise can cause sugar spiking and consequent energy depletion early in race. Before training go for low GI foods which will maintain blood sugar and increase fat metabolism. After demanding exercise high glycaemic index food can restore and rejuvenate muscle faster. However, if you are exercising to reduce or maintain weight it is better to stick with low GI after exercise.

LOW GI <50		MODERATE GI 50-69		HIGH GI >70	
Eggs, fish, meats	0	Potato – boiled	49-56	White bread	70-75
Hummus	6	Blueberry muffin	50	Potato – new	70-78
Yoghurt – natural	11-16	Rye bread	50	Cornflakes	72-77
Dhal, chickpea	11-31	Pineapple	51	Toast – jam&pnb	72
Peanuts	13-23	Coke – soft drinks	53-68	Sultana bran	73
Beans	14-24	French Fries	54	Honey	74
Carrots – raw	16	Raisins	54	Yam – boiled	74
Lentils – boiled	18-30	Vogel Honey & oat	55	Bran Flakes	74
Cherries, Plum – raw	22-24	Rice – white	56	Mashed potato	74
Peas – boiled	22	Macaroni	56	Maize porridge	74
Milk, skim -whole	24-40	Baked beans	56	Swiss Rye bread	74
Grapefruit – raw	25	Muesli (Sanitarium)	57	Corn chips	74
Apple, Peach – raw	28-34	Weet-bix – bran	57	Pumpkin boiled	75
Banana – ripeness	30-46	Potato – white	61-66	Doughnut	75
Smoothie drinks	30-32	Porridge (Hubbards)	58	Grapenuts cereal	76
Butter/Navy Beans	30	Rice – long grain	58	Coco-Pops cereal	77
Orange – raw	31-48	White bread & butter	59	Kumara	77
Dates – dried	31-36	Just Right cereal	60	Gatorade	78-89
Apricots – dried	32	Vegetable soup	60	French baguette	78
Spaghetti	32-44	Bran muffin	60	Rice milk	79
Carrots – boiled	33	Paw paw	60	Broad beans	79
Pear – raw	33-41	Raisin bran	61	Potato Instant mash	80-96
Pea - cooked	35-39	Hamburger bun	61	White bread- gl free	80
Milo, full fat milk	36	Porridge, organic oats	63	Pizza – ch & tom	80
Burgen Bread (s&l)	36	Beetroot	64	Fried rice	80
Ice cream, yoghurt	36	Muesli – toasted	65-67	Rice bubbles	81
All bran cereal	38	Cornflakes & milk	65	Potato – microwave	82
Rice – long grain	38-41	Pancakes	66	Oat cereal –instant	83
Muesli – natural	40	Beer (Tooheys)	66	Sugar	84
Mango	41	Nutrigrain	66	White bread – wheat	88
Rye bread	41-48	Raisins	66	Fruit bars (U Toby)	90
Apple juice	41	Potato – mashed	67	Rice cracker	91
Oat Porridge	42-49	Shredded wheat	67	Rice Milk – low fat	92
Rice – parboiled	42	Fanta	68	Cornflakes (US/UK)	92-132
Up & Go breakfast	43-46	Pita bread	68	Potato – boiled	96
Multigrain bread	43	Ice cream (choc)	68	Potato – baked	98
Muesli – toasted	43	Potato baked	69	Fruit bar – processed	99
Carrot juice	43	Bagel	69	Pancakes – buckwh	102
Sweet corn	46	Special K cereal	69	Jasmine rice (Thai)	109
Wholegrain breads	47-51	Weet-Bix	69	Maize porridge	109
Salmon sushi	48	White fibre bread	69	Fruity-Bix (NZ)	113
Grapes – raw	49	White rice boiled	69		