

Glycemic Control and Health

Selected Readings

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Updated: March 1, 2006

Foreword

Glycemic control is becoming widely recognized as an important issue in human nutrition and health. We have long known that generally high levels of blood sugar (fasting blood glucose levels above 120 mg/dL) are a risk factor for (and symptom of) type 1 and type 2 diabetes. But with the growing prevalence of type 2 diabetes and metabolic syndrome, we have come to appreciate the importance of “glycemic stress” as a factor in determining the risk, onset and progression of these and related disorders. Specifically, scientific research is pointing to the importance of calorie overload, insulin resistance, and frequent, broad excursions in blood sugar as leading dietary risk factors for overweight and obesity, metabolic syndrome, and eventually, type 2 diabetes.

In the simplest terms, calorie overload involves an imbalance between calories consumed via diet versus calories burned through resting metabolism and physical activity. When we eat too much and exercise too little, we are in a state of calorie overload, the most obvious symptom of which is weight gain. But other factors are involved. We are typically not just gaining weight, we are gaining body fat. And body fat is not a physiologically inert tissue. Recent research indicates that it is “hormonally active”, that it is associated with increased levels of oxidative stress, and that by its sheer mass, it imposes additional physical stress on our bodies and organs.

Frequent, broad excursions in blood glucose are a second risk factor for metabolic syndrome and type 2 diabetes. Virtually every time we eat, we experience a rise in blood glucose as our foods are digested and sugars enter our blood stream. When we eat big meals rich in simple sugars and starches, the rises in blood sugar tend to be very high. In response, our bodies produce large amounts of insulin to drive that sugar into our cells where it can be used for energy. As this happens, our blood sugar drops, often below pre-meal levels. This makes us hungry and stimulates us to eat again, producing another rise and subsequent fall in blood sugar and encouraging a self-perpetuating cycle. In the short-term, these frequent and broad fluctuations in blood sugar lead to over eating, mood swings, and weight gain. In the long-term they are risk factors for metabolic syndrome, diabetes, heart disease, and other chronic disorders.

Glycemic index and glycemic load are two characteristics of foods and diet that are relevant to this discussion. The glycemic index of a food is a measure of the rise in blood sugar that is produced by eating a set amount of that food. Foods with a high glycemic index produce large rises in blood sugar per unit of carbohydrate consumed. Foods with a low glycemic index produce small to modest rises in blood sugar per unit of carbohydrate consumed. The concept of glycemic load adds to the equation the amount of food you eat. If you eat a large amount of a high glycemic food (i.e. if you consume a large glycemic load) you will experience a much higher rise in blood sugar than if you eat a small amount of a high glycemic food or a moderate amount of a low glycemic food (i.e. if you consume a small glycemic load).

Insulin sensitivity is an additional factor of importance in glycemic control. When we are sensitive to our own insulin, it can readily shunt blood sugar into our cells where it is “burned” as energy and thereby disposed of. This helps to maintain healthy levels of sugar in our blood stream. But when we become insulin insensitive, or insulin resistant, we have trouble using and disposing of blood sugar. In response, our bodies over-produce insulin, which in the short-term exacerbates weight gain and in the long-term leads to metabolic syndrome and type 2 diabetes. Regular physical exercise and responsible weight management are keys to maintaining good insulin sensitivity.

The following is a list of bibliographic references for recent scientific papers describing research on the health implications of glycemic control, glycemic stress, glycemic index, glycemic load, and insulin sensitivity. The list is representative but not exhaustive. Papers were selected on the basis of scientific merit and relevance to the field.

Keep in mind too that the concepts of glycemic index and glycemic load are still controversial (although rapidly gaining in acceptance). As such, papers have been included in this bibliography, regardless of their results and conclusions. Our objective in compiling this list was to provide readers with a good cross section of the scientific literature so that they can develop a sense for the current state of research in this field and draw their own conclusions concerning the roles of glycemic control and glycemic stress in human health.

Abstracts for most of the papers cited in this bibliography can be obtained on-line at www.ncbi.nlm.nih.gov/pubmed/. In PubMed, select Single Citation Matcher from the PubMed Services, enter the bibliographic information for the article you wish, and click on "Go". This will bring up the single citation. Double click on the authors' names (in blue) to view the full abstract. You can also double click on "Related Articles" to find additional papers of similar content.

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Selected Readings

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