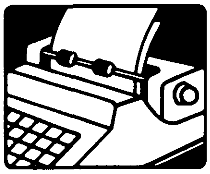
Editorial



The Glycemic Index: Meat and Potatoes or Just Gravy?

In 1674, Sir Thomas Willis attributed the polyuria of diabetes to thin blood and proposed the therapeutic use of dietary starch and salt as a means of thickening the blood, as one would thicken gravy. Since then, recommendations for the inclusion of carbohydrate in diabetic diets have been predicated on the understanding (and misunderstanding) of the pathophysiology of diabetes. Thus, dietary recommendations vacillated between low (1) and high (2) carbohydrate content depending on the prevailing attitude regarding the effect of carbohydrate on glucose control. Seminal observations by Himsworth (3) in the 1930s exonerated carbohydrate as a cause of worsening metabolic control and led to the current widespread acceptance of carbohydrate as an integral component of diabetic diets.

The most recent diet controversy revolves around what type of carbohydrate is appropriate for the diabetic person rather than how much carbohydrate. This controversy was spawned by the results of studies by Crapo et al. (4,5) that demonstrated that all carbohydrates are not equal in their effect on glucose profiles. The initial studies used individual food substances, not in the context of mixed meals, and showed that *1*) similar quantities of different simple sugars (e.g., sucrose vs. fructose) had variable effects on the postprandial glucose levels (5), *2*) the form of a food (e.g., glucose drink vs. glucose meal) influenced the resultant glucose profile (4), and *3*) different carbohydrate food sources (e.g., potato, rice, and pasta) containing similar carbohydrate and caloric content appeared to have very different effects on postprandial glucose levels (4). Differences in digestibility, fiber, and fat content, the presence of antinutrients, and other factors were invoked to explain the differences in the glycemic effect of the foodstuffs.

Jenkins and co-workers employed these observations to generate a "glycemic index," a means of comparing carbohydrate-containing foods on the basis of their effects on postprandial (2-h) glucose profiles relative to a similar gram quantity of glucose (6) or white bread (7). This functional measurement was used to classify various carbohydrate-containing foods in nondiabetics (6) and subsequently in type II (8) and type I (9) diabetic patients. The glycemic index challenged the validity of exchange lists that were based on equivalent grams of carbohydrate. In fact, the original exchange list (1950) proposed by the American Dietetic Association, American Diabetes Association, and the U.S. Public Health Service (10) noted that the fiber content and food form (e.g., raw vs. cooked) might affect the "available" carbohydrate in food and used only the starch and sugar content of food in their calculations. Therefore, in a sense, there was some recognition that different carbohydrates might have a variable effect on glucose levels. More recently, special reports (11), policy statements (12), and position papers (13) have appeared regularly and have made modest changes in the original dietary recommendations. The major new recommendations include an increase in carbohydrate and fiber and a decrease in fat and and cholesterol content as well as the allowance of modest amounts of sucrose.

There has been general acceptance of the glycemic index as a means of measuring the effect of individual carbohydrate-containing foods on glycemia but no agreement on its clinical relevance. The specific sources of controversy include: *1*) Are glycemic indices calculated for individual foods valid when the carbohydrate is included in a mixed meal? *2*) Does the glycemic index pertain to both type I and type II diabetic patients? The most recent studies, including three in this issue, have begun to reassemble realistic meals and study these issues. The reasoning behind these studies seems sound: very few patients eat a meal consisting of only boiled potatoes, rice, or legumes. The study by Coulston et al. selected several carbohydrates for their high-, medium-, or low-glycemic indices and studied their impact on postprandial glucose levels when included in a mixed meal. Although one could quibble with the power of the study to detect small differences between the meals, the results indicate no significant impact of the glycemic indices in the context of a mixed meal for these oral-agent–treated type II diabetic subjects. Laine et al. constructed three different meals using the ADA exchange list and included carbohydrate selections with either high-, intermediate-, or low-glycemic indices in the three meals. The similar glucose levels after the meals in the oral-agent–treated type II diabetic subjects suggest that the ADA exchange diet more accurately predicted postprandial glucose levels than the glycemic index in the context of a mixed meal. This study was particularly admirable in providing power calculations and following the glucose profiles and expired hydrogen to measure malabsorption for many hours after the meal. The study by Hermansen et al. utilized a mixed meal with carbohydrate supplied by a single source (potato vs. pasta) in type I diabetic subjects. This study resembles one by Coulston et al. (14) in utilizing a single food source to supply the different glycemic-index meals. However, the Hermansen study in type I diabetic subjects arrived at a different conclusion than the Coulston study in type II subjects. In the study with type I diabetic subjects, although there was some dilution of the glycemic index in the mixed-meal setting, the glycemic index still predicted the glucose profile. In the study with type II diabetic subjects the glycemic index only predicted higher glucose values after a meal with potato but did not discriminate between rice-, spaghetti-, and lentil-containing meals.

What conclusions can be drawn from these carefully performed studies? First, to examine the glycemic index realistically, whole meals must be studied. In some circumstances, when single foods (e.g., ice cream snacks; 15) are eaten alone, the glycemic index may help predict the magnitude of glucose excursions. Second, the clinical relevance of the glycemic index may differ for type I and type II diabetics. Because glucose levels in type I diabetic patients are more likely to fluctuate with dietary carbohydrate because of their total inability to respond with endogenous insulin, the demonstration of an effect of glycemic index in type I but not type II diabetic subjects should not be surprising. Whether diet- or insulin-treated type II subjects respond differently than oral-agent–treated subjects in the Coulston and Laine studies has yet to be determined.

With the great increase in dietary sophistication in the past decade, clinicians should not lose sight of the most important lessons. For most type II diabetic patients, a hypocaloric, low-fat diet is of primary importance. Most type I diabetic patients need consistency and regularity in their diets, and the ADA exchange system can help provide structure. More sophisticated diets utilizing the glycemic index might be most appropriate in conjunction with intensive therapy in type I patients, where careful glucose monitoring and insulin adjustment are geared to attain near-normal glucose levels.

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