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More on the GI Debate

Attribution of the benefits of a low-glycemic index (GI) diet is usually confounded because these diets generally have a higher dietary fiber content or represent better food choices, such as including more fruits and vegetables. The International Life Science Institute (ILSI) review (11), which was published last January, reflected this conundrum. However, a recent Canadian study attempted to address it. The authors of the Canadian study concluded that a diet they called a “high cereal fiber diet” was less effective in reducing the most important marker of glycemic control, hemoglobin A1c (HbA1c), than a low-GI diet. However, a closer look at what was fed to subjects raises serious questions about the conclusion. Subjects were randomized into two dietary groups in which carbohydrate foods varied as follows. Those in the low-GI group were instructed to eat breads, including pumpernickel, rye pita, and quinoa and flaxseed, and breakfast cereals, including Red River Cereal (a hot cereal made of bulgur and flax), large-flake oatmeal, oat bran, and Bran Buds (a ready-to-eat cereal made of wheat bran and psyllium fiber), pasta, parboiled rice, beans, peas, lentils, and nuts. Those in the high cereal fiber group were advised to take the “brown” option (whole wheat and other grain breads and crackers, except those used by the other group), whole grain cooked and ready-to-eat breakfast cereals, brown rice, and potatoes with skins. (It should be pointed out that under the Canadian Food and Drug Regulations, up to 5% of the kernel can be removed to help reduce rancidity and prolong the shelf life of whole wheat flour. The portion of the kernel that is removed for this purpose contains much of the germ and some of the bran. This also could cause some unintended differences in contributions by the whole grain foods.)

The number of cereal servings suggested for each participant was determined by caloric need. In addition, both groups were specifically advised to avoid foods such as pancakes, muffins, doughnuts, white buns, bagels, rolls, cookies, cakes, popcorn, French fries, and chips. They were also advised to eat three servings of fruits and five servings of vegetables. In the low-GI diet, the allowed fruits were apples, pears, oranges, peaches, cherries, and berries. In the high cereal fiber diet, the allowed fruits were bananas, mangos, guavas, grapes, raisins, watermelon, and cantaloupe. Participants were asked to avoid fruits from the other group.

While there was an attempt to match dietary fiber in the study, this was not completely successful. With the diet labeled “low GI,” there were 42 g of dietary fiber per day, and in the diet labeled “high cereal fiber,” there were only 35 g of dietary fiber per day. While both diets are high in fiber and yield an enviable amount of dietary fiber compared with the embarrassingly low intake of most North Americans of 12–15 g per day, the low-GI diet contained 7 g more of dietary fiber per day than the high cereal fiber diet. While this number may not seem large, it is half of what many North Americans normally consume. Further scrutiny shows that the low-GI diet not only had more total fiber, it contained many more foods with viscous (soluble) fibers. Viscous fibers like those in oatmeal and oatbran, psyllium, and legumes have been associated with lowering blood glucose and improving blood lipid profiles to a greater degree than the insoluble fibers, which clearly predominate in the high cereal fiber diet. Also, rye, flax, legumes, and nuts have more phytoestrogens than those foods allowed in the high cereal fiber diet. Foods with viscous fibers and with phytoestrogens have been shown in numerous previous studies to improve lipid or blood glucose profiles (9,10,12,13,16,20). Thus, this study adds to a rich body of literature showing that diets with the greatest total fiber and the greatest viscous fiber content have positive impacts on blood glucose and blood lipid responses. However, authors cannot conclude that the low GI of the diet was the sole reason for the observed effects. Unfortunately, the confusion due to fiber amount and type and differences arising from food choice (e.g., type of fruit) was also not eradicated by this study design. So, there is still not a clear-cut conclusion that the lower GI of the diet is the reason for the better blood sugar and lipid profiles.

Not only is the type of carbohydrate a subject of debate for both general and therapeutic diets, but the amount of carbohydrate is also a source of controversy. A recent study (19) addressed the question of how much carbohydrate should be used for treating overweight type 2 diabetics. In this study, a diet extremely low in carbohydrate (a ketogenic diet with less than 20 g of carbohydrate daily) was compared with a reduced-calorie, low-glycemic diet (500-kcal/day deficit) to test which would have better outcomes for obese type 2 diabetics. Nearly 60% of the 84 subjects completed the six-month protocol. All completers showed improvements in HbA1c, fasting glucose, fasting insulin, and weight loss. However, those on the ketogenic diet showed a significantly greater drop in HbA1c (–1.5 vs. –0.5%) and greater total weight loss (–11.1 vs. –6.9 kg). Furthermore, those on the ketogenic diet showed an increase in high-density lipoprotein (HDL) of 5.6 mg/dL compared with no change in HDL for the low-glycemic, reduced-calorie group. Diabetes medications were reduced or eliminated in more than 95% of the participants on the ketogenic diet and in 62% of those on the low-glycemic diet. This study with obese type 2 diabetics would indicate that a ketogenic diet might be advantageous.

A ketogenic diet was also tested in those with metabolic syndrome (METs) (18). This 12-week study compared two 1,500-kcal weight loss diets in 40 subjects with atherogenic dyslipidemia. One diet had only 12% of energy from carbohydrates, so it was a severely carbohydrate-restricted diet (% carbohydrate/fat/protein = 12:59:28). The other diet was a typical low-fat diet (56:24:20). Metabolic endpoints improved for subjects on both diets; however, subjects eating severely carbohy-

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drate-restricted diets had consistently better blood sugar control than those eating the low-fat diet. With the severe carbohydrate restriction, there was a 12% greater reduction in blood glucose and a 50% greater reduction in serum insulin concentrations. Insulin sensitivity also increased with the extremely low-carbohydrate diet.

There was improvement in measures beyond blood glucose. Weight loss was 10% greater on the severely carbohydrate-restricted diet than on the low-fat diet. In addition, the blood lipid picture improved with carbohydrate restriction. Triglycerides were 51% lower and HDL-cholesterol was 13% higher and the total cholesterol/HDL-cholesterol ratio was also improved on the carbohydrate-restricted diet compared with the low-fat diet. Similarly, postprandial lipemia dropped by 47%, the Apo B/Apo A-1 ratio decreased by 16%, and there was a shift in LDL particle distribution toward the less-artherogenic, larger low-density lipoprotein (LDL) particles with the ketogenic diet. The authors concluded that severe carbohydrate restriction is an effective approach to improve features of METs and cardiovascular risk in the short term.

More research is needed to show the effectiveness of these extreme diets in the long term. Studies like those of Dansinger (5) show that the extreme diets face problems of greater subject dropout over the long term, and while they are more effective initially, their effectiveness diminishes because of problems with compliance. Many of the advantages seen with such diets fail to be maintained in longer-term studies (5). For example, a study was just published involving 54 extremely overweight Israeli teens (6). At the end of a year, there were no measureable differences in body mass index or any other measure save a drop in insulin levels with the low-carbohydrate diet. These data are also reflected in a recent Cochrane review (15). This systematic review suggests that fat-restricted diets are no better than calorie-restricted diets in achieving long-term weight loss in overweight or obese people. Overall, participants lost slightly more weight on the control diets but this was not significantly different from the weight loss achieved through dietary fat restriction and was so small as to be clinically insignificant. The other Cochrane review (17) showed that a low-GI diet served overweight and obese people well in the short term. They lost more weight and showed greater improvement in their lipid profiles than those on a low-fat, calorie-restricted diet. However, the reviewers concluded with the following statement, "Further research with longer term follow-up will determine whether improvement continues long-term and improves quality of life" (17). Thus, the question about long-term effects of a low-GI diet remains unresolved. What is clear is that a diet with adequate fiber and lots of fruits and vegetables and whole grains promotes positive end points.

Dietary Patterns vs. Individual Foods, Food Groups, or Nutrients and Disease Risk

Single foods or nutrients and their relationship to disease risk are no longer the sole focus of epidemiological research. Some studies assess overall dietary patterns and their relationship to chronic disease. For example, the INTERHEART study, a standardized case-control study involving 5,761 cases and 10,646 control subjects from 52 countries, assessed the risk of acute myocardial infarction (AMI) and its relationship to major dietary patterns (8). These patterns included the oriental pattern with its high intake of tofu and soy and other sauces, the Western pattern with its high intake of fried foods, salty snacks, eggs, and meat, and the prudent pattern with its high intake of fruits and vegetables. It might come as no surprise that the pattern with the high intake of fruits and vegetables lowered the risk of AMI. Those in the quartile eating the most fruits and vegetables, compared with those eating the least, had an adjusted odds ratio (OR) for AMI of 0.70. The Western pattern showed a U-shaped association with AMI risk in that the OR for the second quartile dropped to 0.87, but it increased above 1.0 for the third and the fourth quartiles. In fact, the OR was higher for the fourth quartile than for the third. The oriental pattern demonstrated no relationship with AMI.

This study also assigned dietary scores to certain food patterns. A poor diet, defined as one high in meat, salty snacks, and fried foods and low in fruits, green leafy vegetables, cooked vegetables, and other raw vegetables, resulted in a high overall dietary risk score. As the dietary risk score increased and the diet quality decreased, the OR steadily increased. The OR for AMI was 1.92 for those with the poorest diets (the fourth quartile) compared with those with a better diet (those in the first quartile). The authors (8) concluded that an unhealthy dietary intake, assessed by their simple dietary risk score, increases the risk of AMI and accounts for approximately 30% of the population-attributable risk.

Similar results are seen in other studies. In an 18-year, follow-up study with 72,000 U.S. women in the Harvard nurses cohort (7), researchers noted that the regular ingestion of a prudent dietary pattern, represented by high intakes of vegetables, fruit, legumes, fish, poultry, and whole grains (in this study a high score), was associated with a 28% decreased risk of cardiovascular mortality compared with those eating a Western dietary pattern. The Western pattern included high intakes of red and processed meats, refined grains, French fries, and sweets and desserts. Those scoring high on the prudent dietary pattern also had a 17% lower risk of all-cause mortality than those scoring high on the Western pattern. Furthermore, statistical analysis showed that those eating the Western pattern, compared with those eating a prudent pattern, were associated with a 22% higher risk of mortality from cardiovascular disease, a 16% higher risk of mortality from cancer, and a 21% greater risk of mortality from all causes. The authors (7) suggested that regular selection of a prudent diet pattern by healthy women over a significant period of their adult life may reduce the risk of mortality from a number of chronic diseases.

Similarly, in a cohort involving 74,607 men and women 60 years or older within the European Prospective Investigation into Cancer and Nutrition (EPIC-Elderly cohort) (2), the overall mortality risk was 14% lower for those ingesting a more plant-based diet. The association was stronger in some countries, specifically Greece, Spain, Denmark, and the Netherlands. However, in two countries—the United Kingdom and Germany—the association was not observed.

In the Swedish INTERGENE, with a population of women and men aged 25–74 years, those in the cohort who reported food patterns characterized by more frequent consumption of high-fiber and low-fat foods and lower consumption of products rich in fat and sugar had lower body mass indexes and waist-to-hip ratios than those in the cohort reporting that they consumed a food pattern with high levels of energy-dense drinks and white bread and low consumption of fruits and vegetables (3).

This sampling of cited studies all show that eating a food pattern that in some way incorporates aspects of recommendations from numerous health promotion and government bodies around the world generally lowers overall mortality risk and reduces the risk of chronic disease. Furthermore, the results of the various studies affirm that patterns of food choice, not just individual food choices, impact disease risks. However, interpreting exactly what these studies mean often fails to give any greater clarity or less confusion than if a single nutrient or food group is associated with reduced risk. For instance, the EPIC study of the over-60 year olds, showed that eating a plant-based diet was protective in several countries in the study, but not in the United Kingdom and Germany. How does one interpret the results? Is there no effect in the United Kingdom and Germany because the per capita consumption of beer or alcohol is greater than the other countries in the comparison (1,21)? Do dietary combinations, methods of preparation, or choice of particular plants or combination of plants negate the positive effect of a plant-based diet? For instance, many countries in southern Europe eat only half the quantity of potatoes per capita as is eaten in Germany or the United Kingdom. Is the potato different from other plants? Alternately, are some other factors as effective as a plant-based diet in reducing mortality? Diets in countries such as the United Kingdom or Germany have higher meat intake. Does the meat intake nullify the positive effect of plants? These are some of the numerous questions that can arise with these cluster or dietary pattern analyses. So, while clusters of food reflect a pattern of what people eat, data from patterns of food are no easier to interpret than those using single foods, nutrients, or food groups. However, what is encouraging is that there is general agreement that continuous selection of recommended choices appear to be the prudent move.

Cereal Foods and Their Ingredients Are Functional

The fructooligosaccharide inulin is one type of dietary fiber. It has been suggested to have beneficial effects on blood glucose and blood lipid attenuation. Wheat has inulin and it contributes a significant share to the diet because wheat products are consumed frequently. One strategy to increase inulin in the diet is through its addition to food. However, addition of fiber to a food requires study to show that its addition delivers the expected physiological functionality. To that end, inulin-enriched pasta was fed to 22 healthy male volunteers (14). Those fed the inulin pasta compared with traditional pasta showed significant increases in HDL-cholesterol, an improved total cholesterol/HDL-cholesterol ratio and lipoprotein(a), and lowered serum triglycerides concentrations (data analyzed by Friedman test). While all the changes were very beneficial, the fact the inulin pasta increased HDL-cholesterol concentrations by 35.9% is important because not many dietary changes cause such a huge increase in HDL. Furthermore, it is noteworthy that the changes occurred in young healthy volunteers, since sometimes effects can only be seen in those with abnormal lipids. The data in this study agree with the results of a review of studies relating inulin in the diet to blood lipids in humans (4). The meta-analysis of the human data included 15 randomized, controlled trials. Inulin-type fructans dropped serum triglycerides an average of 7.5%. The effect appeared to be significant for both genders and various metabolic states, such as METs and diabetes. The postulated mechanisms suggest an effect related to colonic fermentation or to incretin release from the distal gut or a synergy of these two effects. Incretin can cause insulin release, which would cause the clearance of blood glucose, and it could slow the rate of absorption of nutrients into the blood stream by reducing gastric emptying. Later this could potentially mean positive effects on satiety as well as triglycerides.

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