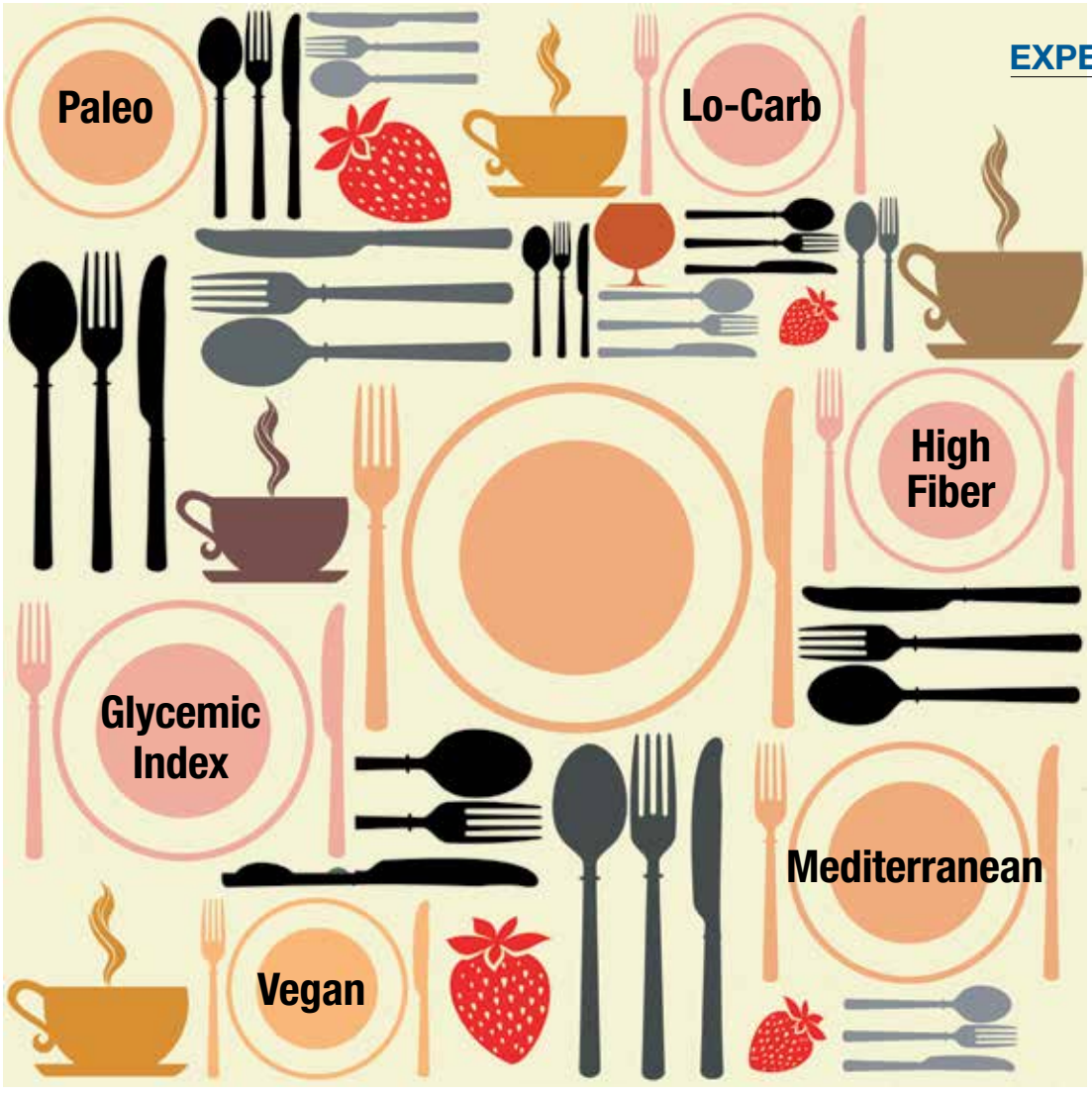

Which Diet for Type 2 Diabetes?

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Prescribed diets can be trying for both patients and providers; patients often struggle to adhere to them, and providers must determine which plan is suitable for which patient. The optimal diet for patients with diabetes—and whether it is sustainable—remains controversial.

A plant-based diet high in polyunsaturated and monounsaturated fats, with limited saturated fat and avoidance of trans-fatty acids, is supported by the American Association of Clinical Endocrinologists. Caloric restriction is recommended when weight loss is appropriate.[1] The American Diabetes Association (ADA) recommends a Mediterranean-style diet rich in monounsaturated fats with carbohydrates from whole grains, vegetables, fruits, legumes, and dairy products, and an emphasis on foods higher in fiber and lower in glycemic load.[2]

Additionally, the ADA, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics advise that all individuals with diabetes receive individualized Medical Nutrition Therapy (MNT), preferably with a registered dietitian nutritionist (RDN) knowledgeable and skilled in providing diabetes-specific nutrition education. MNT delivered by an RDN has been shown to reduce A1C levels by up to 2% in people with type 2 diabetes (T2DM).[3]

This flexibility in recommendations cre-

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ates uncertainty about the correct dietary choice. Several diet plans are endorsed for the management of diabetes, including Mediterranean, low carbohydrate, Paleolithic, vegan, high fiber, and glycemic index (GI). Which should your patients adhere to? Several randomized controlled trials (RCTs), meta-analyses, and literature reviews have examined and compared the benefits of these eating habits for management of diabetes.

MEDITERRANEAN

The Mediterranean diet incorporates plant foods such as greens, tomatoes, onions, garlic, herbs, whole grains, legumes, nuts, and olive oil as the primary source of fat. A crossover trial of adults with T2DM demonstrated a statistically significant A1C reduction (from 7.1% to 6.8%) after 12 weeks on the Mediterranean diet.[4]

In a systematic review of 20 RCTs, Ajala et al analyzed data for nearly 3,500 patients with T2DM who adhered to either a low-carbohydrate, vegetarian, vegan, low-GI, high-fiber, Mediterranean, or high-protein diet for at least six months. The researchers found that Mediterranean, low-carbohydrate, low-GI, and high-protein diets all led to A1C reductions—but the largest reduction was observed with patients on the Mediterranean diet. Low-carbohydrate and Mediterranean diets resulted in the most weight loss.[5]

With low-carb diets, the majority of weight loss was explained by a decrease in body fat, not loss of water weight.

LOW-CARBOHYDRATE

Low-carbohydrate diets have decreased in popularity due to concerns about their effects on renal function, possible lack of nutrients, and speculation that their macronutrient composition may have effects on weight beyond those explained by caloric deficit. A meta-analysis of 13 studies of adults with T2DM following a low-carbohydrate diet (≤ 45% of calories from carbohydrates) demonstrated beneficial effects on fasting glucose, A1C, and triglyceride levels. Nine of the studies evaluated glycemic control and found A1C reduction with lower carbohydrate diets; the greatest reductions in A1C and triglycerides were correlated with the lowest carbohydrate intakes. No significant effects were seen for total, HDL, or LDL cholesterol.[6]

In the literature review by Ajala et al, low-carbohydrate, low-GI, and Mediterranean diets all improved lipid profiles. HDL cholesterol increased the most with a low-carbohydrate diet.[5]

A two-week study of 10 adults with T2DM found that just one week on a low-carbohydrate diet decreased the average 24-h plasma glucose from 135 mg/dL to 113 mg/dL. Over the two-week study period, triglycerides decreased by 35%, cholesterol by 10%, and A1C by 0.5%. Patients were allowed to consume as much protein and fat as desired. Food sources included beef and ground turkey patties, chicken breasts, turkey, ham, steamed vegetables, butter, diet gelatin, and a limited amount of cheese. Mean calorie intake decreased from 3,111 to 2,164 calories/d. Carbohydrate intake decreased from 300 to 20 g/d. Weight loss was entirely explained by the mean energy deficit.[6] Patients experienced no difference in hunger, satisfaction, or energy level with a low-carb diet compared to their usual diet.[7]

A literature review of six studies examined the effects of low-carb diets (between 20-95 g/d) on body weight and A1C in patients with T2DM. Three of the studies restricted carbohydrate intake to less than 50 g/d. All reported reductions in body weight and A1C. In two studies, the majority of the weight loss was explained by a decrease in body fat, not loss of water weight. No deleterious effects on cardiovascular disease risk, renal function, or nutritional intake were seen. The researchers concluded that low-carb diets are safe and effective over the short term for people with T2DM.[8]

PALEOLITHIC

The Paleolithic diet (also referred to as the *caveman diet*, *Stone Age diet*, and *hunter-*

gatherer diet) involves eating foods believed to have been available to humans before agriculture—this period began about 2.5 million years ago and ended about 100,000 years ago. Food sources include wild animal meat (lean meat and fish) and uncultivated plant foods (vegetables, fruits, roots, eggs, and nuts). It excludes grains, legumes, dairy products, salt, refined sugar, and processed oils.

In a randomized crossover study of 13 participants with T2DM, the Paleolithic diet improved glucose control and several cardiovascular disease markers, compared to a standard diabetes diet. The Paleolithic diet resulted in significantly lower A1C, triglycerides, diastolic blood pressure, body weight, BMI, and waist circumference, as well as increased HDL. Despite receiving no instruction to restrict calories, patients on the Paleolithic diet consumed fewer calories and carbohydrates, and more protein and fat, than those on the standard diabetes diet. The caloric deficit accounted almost exactly for the observed difference in weight loss between the two groups.[9]

GLYCEMIC INDEX

The GI measures the blood glucose level increase in the two hours after eating a particular food, with 100 representing the effect of glucose consumption. Low-GI food sources include beans, peas, lentils, pasta, pumpernickel bread, bulgur, parboiled rice, barley, and oats, while high-GI foods include potatoes, wheat flour, white bread, most breakfast cereals, and rice.

A meta-analysis compared the effects of high- and low-GI diets on glycemic control in 356 patients with diabetes. Ten of 14 studies documented improvements in A1C and postprandial plasma glucose with lower GI diets. Low-GI diets reduced A1C by 0.43% after an average duration of 10 weeks. The average GI was 83 for high-GI diets and 65 for low-GI diets. The researchers concluded that selecting low-GI foods has a small but clinically relevant effect on medium-term glycemic control, similar to that offered by medications that target postprandial blood glucose excursions.[10]

Low-GI diets resulted in lower A1C and higher HDL but no significant change in weight, according to Ajala et al.[5]

HIGH-FIBER

A survey of 15 studies examined the relationship between fiber intake and glycemic control. Interventions ranged from an additional 4 to 40 g of fiber per day, with a mean increase of 18.3 g/d. Additional fiber lowered A1C by 0.26% in 3 to 12 weeks, compared to placebo. The overall mean fasting blood glucose reduction was 15.32 mg/dL. No study lasted more than 12 weeks, but it is inferred that a longer study could result in a greater A1C reduction. Current dietary guidelines for patients with diabetes exceed the amount of fiber included in most of these studies.[11]

A low-fat vegan diet has acceptability similar to that of a more conventional diabetes diet.

VEGAN

Ajala et al observed that patients on a vegan diet had lower total cholesterol, LDL, and A1C levels, compared to those on a low-fat diet. At 18 months, the vegetarian diet demonstrated improvement in glucose control and lipids, but not weight loss.[5]

In one RCT, a low-fat vegan diet was shown to improve glycemic control and lipid levels more than a conventional diabetes diet did. A1C decreased by 1.23% over 22 weeks, compared to 0.38% in the conventional diet group. Body weight decreased by 6.5 kg and LDL cholesterol decreased by 21.2% with the vegan diet, compared with a weight loss of 3.1 kg and a 10.7% LDL reduction in the conventional diet group.[12]

Patients on the vegan diet derived energy primarily from carbohydrates (75%), protein (15%), and fat (10%) by eating fruits, vegetables, grains, and legumes. Portion size and caloric and carbohydrate intake were not restricted. The conventional diet involved a caloric intake mainly from a combination of carbohydrates and monounsaturated fats (60% to 70%), protein (15%

to 20%), and saturated fat (< 7%). The diet was individualized based on caloric needs and participants' lipid levels. All participants were given calorie intake deficits of 500 to 1000 kcal/d.[13] Participants rated both diets as satisfactory, with no significant differences between groups. The researchers concluded that a low-fat vegan diet has acceptability similar to that of a more conventional diabetes diet.[12]

CONCLUSION

Diabetes management strategies may incorporate a variety of dietary plans. While study populations are small and study durations relatively short, the aforementioned diets show improvement in biochemical markers such as fasting glucose, A1C, and lipid levels. The Mediterranean diet is believed to be sustainable over the long term, given the duration of time that people in the region have survived on it. Low-carbohydrate diets, including the Atkins and Paleolithic diets, are very effective at lowering A1C and triglycerides. Vegetarian/vegan diets may be more acceptable to patients than previously thought.

The long-term impact of any eating pattern will likely relate to adherence; adherence is more likely when patients find a diet to be acceptable, palatable, and easy to prepare. Diet selection should incorporate patient preferences and lifestyle choices, and when possible, should involve an RDN with expertise in diabetes. **CR**

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