Abstract
Medical nutrition therapy (MNT) is proven to be effective in improving glycemic and cardiometabolic management. The American Diabetes Association (ADA) reviewed various eating patterns and showed that there is no "one-size-fits-all" meal plan; each pattern has different strengths in managing glycemia, weight and cardiovascular health. Registered dietitian nutritionists (RDNs) are instrumental in individualizing the meal plan for patients with diabetes which helps to improve their metabolic health outcomes while maintaining the enjoyment of eating.

Introduction
Nutrition therapy is an integral component of managing diabetes. Not only is it cost-effective, but studies have also shown the effect of lowering A1C by 1.9-2.0% for those who have type 1 (T1D) or type 2 diabetes (T2D) (1). Medical nutrition therapy (MNT) is also helpful in lowering cardiovascular risk factors such as decreasing LDL cholesterol, triglycerides and blood pressure (2,3). Most adults 40 to 75 years of age with diabetes are at intermediate or high risk of atherosclerotic cardiovascular disease (ASCVD) (4). Through counseling, RDNs will be able to help individuals establish personalized meal plans to achieve their glycemic, weight and cardiovascular goals, while being able to enjoy the pleasure of eating and honoring their personal and cultural food preferences.

Eating Patterns and Glycemic Management
Attaining glycemic targets is important for the prevention of macrovascular complications for people with T1D or T2D. The glycemic goals may vary for each person based on various factors, including diabetes history, age, hypoglycemic risks and the presence of other complications (5).

Most of the eating patterns reviewed showed mixed effects on glycemic improvement (1). Some benefits were seen in vegetarian/vegan and low-fat eating patterns; however, they may be attributed to weight loss (1,6,7). Meta-analysis showed that low/very-low carbohydrate eating patterns may reduce A1C up to 6 months, however, effects were no longer significant beyond one year (8-10).

When comparing the percentage of calories from carbohydrates, protein and fat, the ideal distribution was not identified (1). The minimum required amount of carbohydrates for optimal health is currently unknown. The recommended dietary allowance for carbohydrates for adults is 130 g/day, but the required amount can be attained by the body's metabolic process (1). Overall, reducing carbohydrates showed the most evidence for improving glycemia and may be applied in a variety of eating patterns (1).

RDNs should provide individual assessments and tailor each meal plan for the management of diabetes. For effective nutrition interventions, RDNs should have three to six MNT encounters during the first 6 months of diagnosis (1). More encounters may be needed based on each person’s assessment. For subsequent years, a minimum of one encounter per year is recommended (1). As part of diabetes self-management education and support, nutrition needs should also be reviewed when new complications appear or when the person has a transition in care (11).
Eating Patterns and Weight Management

Weight loss is effective in managing cardiometabolic health for people with diabetes and with overweight or obesity (1,12). Weight loss of 5% is recommended for those with BMI >25 kg/m² (or BMI >23 kg/m² for Asians/Asian Americans) to achieve clinical benefits. The weight loss effect is progressive. RDNs may provide a plan that targets a 15% or more weight loss for optimal outcomes if feasible and needed (1,13).

Various eating patterns have shown effects on weight loss. Studies analyzing vegetarian/vegan eating patterns often showed weight reduction. A caloric-restricted low-fat eating pattern reduced body weight, as was observed in the Look AHEAD (Action for Health in Diabetes) Trial which consisted of a structured weight loss program using meal replacements. A very low-fat eating pattern within a lifestyle program (e.g., Ornish or Pritikin) was also shown to affect weight loss. Three short-term studies (≤ 20 weeks) showed that intermittent fasting may lead to weight loss. There were mixed results on weight reductions for Mediterranean-style, DASH and paleo eating patterns (1). The weight loss effect of low-carbohydrate and very low-carbohydrate diets were mixed (8-10). A low-carbohydrate, high-fat eating pattern may lead to greater weight loss than a high-carbohydrate, low-fat eating pattern for studies that were shorter than 2 years (12).

Evidence does not suggest any particular meal plan is more superior to another. For effective weight loss and maintenance, an eating plan that tailors to personal food preferences and introduces energy deficit are the cornerstones. Lifestyle intervention for regular physical activity and behavioral strategies are also important (1,14,15). For individuals who may benefit from more frequent MNT encounters for weight management, RDNs are recommended to schedule at least 14 individual or group sessions over six months for weight loss, and have a monthly encounter for at least a year for weight maintenance (16).

Eating Patterns and Cardiovascular Risk

Plant-based and Mediterranean eating patterns, that latter which includes vegetables, legumes, lean vegetable or animal (preferably fish) protein and fruits, are associated with a lower risk of all-cause mortality (4). In a meta-analysis, vegetarian or vegan eating patterns lowered LDL cholesterol (18). Replacing saturated fat with unsaturated fats was associated with reduced cardiovascular disease risk, LDL cholesterol and total cholesterol (1). A Mediterranean-style eating pattern that is high in monounsaturated fatty acids from plant sources (e.g., olive oil and nuts) is shown to improve cardiovascular risk factors (19). Eating patterns that contain foods high in polyunsaturated fatty acids (such as fatty fish or certain nuts and seeds) may also have cardiovascular health benefits (1). Lowering the sodium intake to less than 2,300 mg/day is recommended in preventing and managing hypertension (1). The benefits of substantially lowering the sodium intake to less than 2,300 mg/day for those with diabetes and hypertension is currently not clear, and should only be considered on a case-to-case basis (1).

Carbohydrate-restricted eating patterns lowered triglycerides and increased HDL cholesterol. However, LDL cholesterol response varied, with some experiencing a significant increase in LDL cholesterol (12). The contradicting results may be due to the varying quality of food choices. A high saturated fat content in the very low-carbohydrate and low-carbohydrate meal plans may explain the increase in LDL cholesterol (12). A meta-analysis showed that there was a U-shaped relationship between the percentage of energy consumption from carbohydrates and the mortality rate. The lowest observed risk of mortality was at 50-55% of carbohydrates intake, and the highest risk was associated with those having the lowest carbohydrates consumption. This study further compared the effect of substituting carbohydrates with plant-based and animal-based fat and protein. It showed that replacing carbohydrates with plant-based fat and protein

<table>
<thead>
<tr>
<th>Table 1. Dietary Sources of Omega-3 Fatty Acid, Plant Stanols and Viscous Fibers</th>
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<tbody>
<tr>
<td><strong>Dietary Sources</strong></td>
</tr>
<tr>
<td>Omega-3 Fatty Acid*</td>
</tr>
<tr>
<td>Plant-based: chia seeds, walnuts, flaxseeds,</td>
</tr>
<tr>
<td>flaxseed oil, canola oil, soybean oil, vegetable oil</td>
</tr>
<tr>
<td>Marine-based: salmon, mackerel, sardine, flounder, snapper, tuna</td>
</tr>
<tr>
<td>Plant Stanols/Sterols</td>
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<tr>
<td>Fortified food products to meet the therapeutic dose for 2 g daily for LDL lowering (21).</td>
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<tr>
<td>(e.g., dressings, spreads, vegetable oils, yogurts), whole grains, legumes (e.g., soybeans, peas), nuts, fruits, vegetables</td>
</tr>
<tr>
<td>Viscous Fibers</td>
</tr>
<tr>
<td>Legumes, barley, oats, citrus fruits</td>
</tr>
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preferences, financial situation, health conditions, risk factors and goals. The 2019 ADA nutrition consensus report recommends “focusing on the key factors that are common among the patterns – emphasizing non-starchy vegetables, minimize added sugars and refined grains, and choose whole foods over highly processed foods to the extent possible” (1). During initial and follow up visits, RDNs should work closely with persons with diabetes in developing a personalized eating plan by providing them with strategies for making daily food-related decisions along with accountability and support.

Limitations of the Studies
Most studies reviewed were less than two years of duration and had smaller sample sizes. The quality of food choices in eating patterns may also be overlooked in some studies. Additionally, some of the eating patterns were associated with weight loss, structured lifestyle intervention programs or caloric-restricted meal plans. As such, the health benefits of eating patterns alone may not be clear. Also, few clinical studies were conducted to compare the effects of different eating patterns between one another. Maintaining adherence to food intake during the intervention period was another challenge. More future studies of larger scales are needed to provide better understandings of different eating patterns on human health for the long term.

Summary
People with diabetes have a high risk of cardiovascular disease. A variety of eating patterns may be effective in managing diabetes and weight. Plant-based, Mediterranean and DASH eating patterns are associated with reduced risk of cardiovascular disease and improvements in risk factors. When providing nutrition consultation, it is important to individualize the meal planning according to each person’s cultural and food preferences, financial situation, health conditions, risk factors and goals. The 2019 ADA nutrition consensus report recommends “focusing on the key factors that are common among the patterns – emphasizing non-starchy vegetables, minimize added sugars and refined grains, and choose whole foods over highly processed foods to the extent possible” (1). During initial and follow up visits, RDNs should work closely with persons with diabetes in developing a personalized eating plan by providing them with strategies for making daily food-related decisions along with accountability and support.

References