

# Rationale for the Use of a Mediterranean Diet in Diabetes Management

Gretchen Benson, RD, LD, CDE, Raquel Franzini Pereira, MS, RD, LD, and Jackie L. Boucher, MS, RD, LD, CDE

Recent estimates point to the stark reality that one in three people will have diabetes by 2050.<sup>1</sup> As the epidemic of diabetes continues to grow, educators aim to help those with diagnosed diabetes live healthier lives.

To date, much evidence-based information exists on how to help our patients reduce their health risks and potentially add quality years to their lives. Both lay and professional publications often emphasize managing the ABCs—A1C, blood pressure, and cholesterol—for optimal diabetes management. The American Diabetes Association (ADA) recommends lowering A1C to < 7%, controlling blood pressure to < 130/80 mmHg, and controlling LDL cholesterol to < 100 mg/dl (< 70 mg/dl for those with diagnosed cardiovascular disease [CVD]) to reduce the risk of microvascular and cardiovascular complications.<sup>2</sup>

Although these recommendations have not shifted greatly over the years, diabetes management in the population continues to be less than optimal. Data from the National Health and Nutrition Examination Survey of 2001–2002 indicated that an estimated 53% of individuals with diabetes failed to attain target blood pressure levels, and 50.2% were not at goal for A1C.<sup>3</sup> Given these statistics, it is not surprising that death from coronary heart disease (CHD) and the risk of having a stroke is two to four times greater in adults with diabetes than in those without diabetes.<sup>4</sup>

Nutrition therapy and regular physical activity are the cornerstones for managing A1C, blood pressure, and cholesterol, and treatment for each has its own set of nutrition

guidelines. Although there is some overlap in the recommendations, nutrition guidelines can be complex and confusing to people with diabetes who are often working to manage their diabetes in combination with other health risks. For example, nutrition recommendations often require an individual have advanced skills, such as label reading or data interpretation (e.g., calculation of carbohydrate intake, and, for those using insulin, correction factors or insulin-to-carbohydrate ratios).

These may be important considerations given a recently published article pointing to the under-recognized issue of numeracy, or the ability to use and understand numbers, in diabetes management. White et al.<sup>5</sup> found that misinterpretation of food labels was common and occurred even for those with adequate health literacy. Because there are multiple nutrition guidelines (some of which are unclear or conflicting), it is understandable that diabetes clinicians often find patients confused about their nutrition therapy and ultimately about what foods to eat.

The purpose of this article is to discuss national guidelines for the treatment of blood glucose, blood pressure, and cholesterol, including both similarities and differences. A Mediterranean diet, based on a centuries-old eating pattern, is proposed as an eating plan that integrates key elements from nutrition therapy recommended to treat each of these three risk factors.

## Nutrition Therapy Recommendations

It is helpful to begin with a discussion of nutrition therapy for A1C,

blood pressure, and cholesterol. The ADA's diabetes nutrition recommendations focus mainly on carbohydrate monitoring to manage blood glucose.<sup>2</sup> No limits or specific ranges are given for carbohydrates; rather, the method of monitoring carbohydrates can be tailored to patients' individual preference or level of understanding (e.g., carbohydrate counting, exchanges, or experience-based estimation). In addition, the ADA recommendations emphasize reducing saturated fat to < 7% of overall calories and minimizing *trans* fats to prevent or treat heart disease.<sup>2</sup>

Lifestyle modifications, with a particular emphasis on food and nutrition, are recommended for anyone who is not at goal for blood pressure (i.e., who has a blood pressure  $\geq$  130/80 mmHg for an individual with diabetes). The Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommends adopting the Dietary Approaches to Stop Hypertension (DASH) eating plan,<sup>6</sup> which is rich in fruits and vegetables, includes some low-fat dairy products, and calls for sodium intake of  $\leq$  2.4 g/day. This diet also calls for moderation of alcohol (no more than two drinks per day for men and one drink per day for women, with one drink defined as 12 oz of beer, 5 oz of wine, or 1.5 oz of distilled spirits [e.g., whiskey]). Following the DASH style of eating has demonstrated reductions in blood pressure similar to those of treatment with one anti-hypertensive medication.<sup>7</sup>

The Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III [ATP III]) presents guidelines for cholesterol management to reduce the risk of CHD or future events.<sup>8</sup> ATP III recognizes diabetes as a CHD risk-equivalent, and as discussed previously, cholesterol management is a high priority in the treatment of diabetes. The nutrition recommendations within the guidelines, known as the Therapeutic Lifestyle Changes (TLC) diet, provide percentile recommendations

for macronutrients to reduce risk.<sup>8</sup> Although the guidelines are succinct, this approach makes it difficult to interpret the guidelines for both clinicians and patients (i.e., specific recommendations depend on personalized calorie goals and require nutrition label-reading skills).

Table 1 provides the specific details of the TLC diet recommendations. Of note, total fat is provided in a range of 25–35% of total calories to reflect consumption of different types of fats. People are allowed to eat more fat as long as most of the fat comes from healthier sources (e.g., monounsaturated and polyunsaturated fats), limiting the amount of saturated and *trans* fats. Unique recommendations within the TLC diet include options to add stanols/sterols (2 g/day) and increased soluble fiber (10–25 g/day) to maximize LDL cholesterol lowering.

Although some duplication does exist among the nutrition guidelines (e.g., recommendations for fruit, vegetable, alcohol, and saturated and *trans* fat consumption), there are some inconsistencies. What if there were one nutrition strategy that could target all three parameters (blood glucose, blood pressure, and cholesterol), keeping it simple for both health professionals and patients? More importantly, what if this single set of nutrition recommendations could be explained in simple terms (e.g., foods that people eat) and would not require advanced skills (e.g., label reading, calculations)?

The Mediterranean diet may be such a solution. It captures elements of both the TLC and the DASH diets and provides more tangible recommendations (e.g., “Eat more fruits, and limit red meat” vs. “Limit intake of saturated fat to < 7% of overall calories”). Essentially, the Mediterranean diet, by design, affects blood glucose, blood pressure, and cholesterol management, making it an intriguing choice for diabetes clinicians and their patients.

### The Mediterranean Diet

Researchers have used the term “Mediterranean diet” to describe a centuries-old eating pattern that includes mostly plant-based, nutrient-dense foods such as fruits,

vegetables, legumes, nuts, and whole grains, with olive oil as the main fat source. Additionally, the Mediterranean-type diet includes foods rich in omega-3 fatty acids (usually eaten as fatty fish and walnuts), with limited amounts of red meat and other animal products (e.g., butter and other dairy foods).<sup>9</sup> Moderate consumption of wine (i.e., one glass of wine per day for women, and two per day for men) with meals is generally indicated as a component of the eating pattern because there is a potential decrease in lipid peroxidation when dietary polyphenols (from wine) and oxidized fats are consumed in the same meal.<sup>10</sup>

Because the Mediterranean diet is meant to represent the eating patterns of all the countries bordering the Mediterranean Sea, use of this term in research is a misnomer; there is no one single diet that can represent all the economic, cultural, and religious differences that influence the eating patterns of all of these countries. Variations in Mediterranean food patterns make this issue particularly difficult to study, and contradictory results are often found in studies that focus solely on the component foods or food groups.<sup>11</sup> Yet researchers continue to classify this eating pattern as the “Mediterranean diet,” which is why the authors have used the term in this article.

To remedy this classification issue (i.e., variability in actual eating patterns within the Mediterranean region), researchers have developed Mediterranean diet scores or indexes.<sup>12,13</sup> These indexes attempt to assess adherence to a traditional Mediterranean-type diet in research to facilitate analyzing the eating pattern and any related health benefits as a whole. The common belief is that there are unknown, but potentially powerful, synergistic qualities of an overall Mediterranean-style eating pattern that may transcend the qualities of the individual foods within the eating pattern that are known to improve health.

**Health Benefits and Evidence to Support the Use of a Mediterranean Diet in People With Type 2 Diabetes**  
The health benefits of choosing

**Table 1. Comparison of Daily Food and Nutrition Recommendations and Patterns from the DASH, Mediterranean, and TLC Diets**

Eating Pattern	DASH Diet*	Mediterranean Diet**	TLC Diet*
Grains (whole grains recommended)	6–8 servings per day	Daily consumption of several whole grains (minimally processed)	7 servings per day
Fruits	4–5 servings per day	Daily consumption of fruit (seasonally fresh)	4 servings per day
Vegetables	4–5 servings per day	Daily consumption of a variety of vegetables (including root vegetables, if desired) with an emphasis on daily intake of dark leafy greens (seasonally fresh)	5 servings per day
Fat-free or low-fat milk and milk products	2–3 servings per day	Weekly consumption of a small amount of low-fat or fat-free dairy (such as flavorful cheeses and yogurt)	2–3 servings per day
Nuts, seeds, and legumes	4–5 servings per week	Daily consumption of plant foods high in alpha-linolenic acid such as flaxseeds and walnuts; daily consumption of legumes; daily consumption of a small amount of nuts	Counted in vegetable servings
Fats and oils	2–3 servings per day	Daily consumption of extra virgin olive oil used as the main source of fat	Amount depends on daily caloric needs
Lean meats, poultry, and fish	≤ 6 oz per day (limit egg yolks to ≤ 4 per week)	Weekly consumption of omega-3-rich fish, at least 2 servings per week; moderate consumption of poultry and eggs (can be less than once per week, if desired)	Recommend fish, especially oily fish, at least twice a week
Sweets and added sugars	≤ 5 servings per week	Occasional consumption of sweets (can be less than once per week if desired)	No recommendation
Sodium	2,300 mg per day; 1,500 mg per day particularly effective for middle-aged and older individuals, African Americans, and those with high blood pressure	Daily use of herbs and spices instead of sodium to flavor foods	Achievable recommendation: 2,300 mg per day; ideally 1,500 mg per day
Alcohol	For those who drink alcohol, consume ≤ 2 alcoholic drinks per day (men) and ≤ 1 alcoholic drink per day (women)†	Daily consumption of alcohol (red wine), 1–2 glasses per day with meals	If alcohol is consumed, it should be done in moderation (≤ 2 drinks per day for men and ≤ 1 drink per day for women, ideally with meals)
Miscellaneous		Daily use of antioxidant herbs and spices (such as garlic, onions, dill, oregano, and curry powder) to flavor foods	Plant stanols/sterols (add 2 g per day) and soluble fiber (add 5–10 g per day)

\*Consistent with American Heart Association’s recommended nutrition goals at 2,000 calories.

\*\*Unified Mediterranean diet as identified in ref. 12.

† From ref. 6.

an eating pattern similar to the Mediterranean diet are numerous. Benefits specifically related to diabetes include reduction in overall mortality and mortality of CVD,<sup>14</sup> prevention of diabetes, and improvement in glycemic control and cardiovascular risk in people with diabetes.<sup>15</sup>

In a meta-analysis of 17 studies,<sup>15</sup> the Mediterranean-type diet was found to improve fasting glucose and A1C levels for those with type 2 diabetes. In several studies,<sup>16–18</sup> the Mediterranean diet lowered fasting glucose levels in those with diabetes more than did low-fat diets.

The reason for lower fasting glucose levels may be related to the positive effect on insulin sensitivity that results from replacing saturated and *trans* fats with unsaturated fats.<sup>16</sup> Specifically, a low-carbohydrate Mediterranean diet (35% carbohydrate, 45% fat [50% of which is monounsaturated fat], and 20% protein) demonstrated glycemic benefit compared to both a control diet and a traditional Mediterranean diet (both of which contained 40–55% carbohydrate, 30% fat, and 15–20% protein).<sup>19</sup>

One study by Esposito et al.<sup>20</sup> found that adherence to a Mediterranean-type diet decreased A1C levels and postprandial glucose levels measured independently by subjects in their natural environment. In addition, participants with the highest adherence to the Mediterranean diet had lower BMIs, waist-to-hip ratios, and prevalence of metabolic syndrome.

It is important to note that some studies may not separate the effects of the Mediterranean diet from other factors influencing outcomes, such as other risk factor management resources.<sup>15</sup> Therefore, further studies are needed to clarify these issues.

In terms of diabetes prevention, an 83% lower risk of diabetes has been found among those who closely adhered to a Mediterranean diet.<sup>21</sup> Furthermore, adherence to a Mediterranean diet, even without calorie restriction, seems to be effective in preventing diabetes among those at high cardiovascular risk.<sup>22</sup>

The abundant use of olive oil, fruits, and vegetables in this pattern of eating leads to additional health benefits. Using monounsaturated fatty acids (MUFAs) such as those found in olive oil or polyunsaturated fats such as those in seeds instead of saturated or *trans* fatty acids reduces the risk of diabetes.<sup>16</sup> The Mediterranean diet is also inversely associated with arterial blood pressure, and olive oil use specifically may be as important as fruit and vegetable intake for both systolic and diastolic blood pressure control.<sup>23</sup>

The Mediterranean diet may even have positive effects on inflammatory markers<sup>24</sup> and may reduce the risk for peripheral artery disease.<sup>25</sup> Two outcome-based trials that included patients with diabetes demonstrated that a Mediterranean diet reduced cardiovascular and total mortality.<sup>26,27</sup>

### Practical Applications for Diabetes Clinicians

The Mediterranean diet, which is based on a traditional eating pattern, may be a simpler nutrition strategy that can help patients with diabetes achieve more optimal glycemic control and reduce the risk of complications. Before starting patients on this type of eating pattern, it is important to assess what particular meal-planning approach they currently use to account for carbohydrates (e.g., carbohydrate counting, exchanges, or experience-based estimation) in their daily eating pattern and to provide further education if needed. This is essential because patients will likely need to replace existing carbohydrates with healthier versions (e.g., fruits, vegetables, whole grains, and legumes) to adopt a style of eating similar to the Mediterranean diet and achieve their glycemic goals.

Explaining the Mediterranean-style eating pattern as a whole and then allowing patients to choose areas to focus on first is recommended to improve adherence. Specific areas that may be suggested for initial nutrition therapy include reducing the number of meals per week that feature red meat by substituting legumes or fish; increasing the amount of fruits and vegetables

consumed; and replacing saturated fats with monounsaturated fats.

One study<sup>28</sup> conducted to assess the impact of a Mediterranean diet using exchanges for breast cancer prevention found that women who received fairly extensive counseling were able to increase the amount of monounsaturated fat in their diet with very little impact on their overall fat intake. They were also able to double their intake of fruits and vegetables. To increase adoption of Mediterranean diet principles, diabetes clinicians should provide specific examples of foods to include rather than focus on macronutrients or micronutrients as a group.<sup>29</sup>

### Conclusion

Ultimately, patients with diabetes need practical recommendations to help them choose healthier foods without an overly complicated process. Practical information can help patients increase their self-efficacy in eating healthier and better managing their diabetes. An eating pattern similar to the traditional Mediterranean diet can be integrated with existing national guidelines for the management of diabetes, blood pressure, and cholesterol. Existing data suggest that the Mediterranean diet has health benefits, including improved glycemic control and reduced cardiovascular risk,<sup>15</sup> and may offer benefits to diabetes patients and clinicians alike in terms of palatability, ease of explanation and use, and promotion of improved health.

### References

- Boyle JP, Thompson TJ, Gregg EW, Barker LE, Williamson DF: Projection of the year 2050 burden of diabetes in the U.S. adult population: dynamic modeling of incidence, mortality, and pre-diabetes prevalence. *Popul Health Metr* 8:29, 2010
- American Diabetes Association: Standards of medical care in diabetes—2010. *Diabetes Care* 33 (Suppl. 1):S11–S61, 2010
- Centers for Disease Control and Prevention: National Health and Nutrition Examination Survey: NHANES 2001–2002. Available from: <http://www.cdc.gov/nchs/nhanes.htm>. Accessed 11 January 2011
- U.S. Department of Health and Human Services: National diabetes fact sheet, 2007 [article online]. Available from: [http://www.cdc.gov/diabetes/pubs/pdf/ndfs\\_2007.pdf](http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2007.pdf). Accessed 5 November 2010

- <sup>5</sup>White RO, Wolff K, Cavanaugh KL, Rothman R: Addressing health literacy and numeracy to improve diabetes education and care. *Diabetes Spectrum* 23:238–243, 2010
- <sup>6</sup>Appel LJ, Brands MW, Daniels SR, Karanja N, Elmer PJ, Sacks FM; American Heart Association: Dietary approaches to prevent and treat hypertension: a scientific statement from the American Heart Association. *Hypertension* 47:296–308, 2006
- <sup>7</sup>Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7). *JAMA* 289:2560–2571, 2003
- <sup>8</sup>Expert Panel on the Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults: Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on the Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 285:2486–2497, 2001
- <sup>9</sup>Kushi LH, Lenart EB, Willett WC: Health implications of Mediterranean diets in light of contemporary knowledge. *Am J Clin Nutr* 61:1407S–1415S, 1995
- <sup>10</sup>Gorelik S, Ligumsky M, Kohen R, Kanner J: The stomach as a “bioreactor”: when red meat meets red wine. *J Agric Food Chem* 56:5002–5007, 2008
- <sup>11</sup>Hu FB: Dietary pattern analysis: a new direction in nutritional epidemiology. *Curr Opin Lipidol* 13:3–9, 2002
- <sup>12</sup>Bach A, Serra-Majem L, Carrasco JL, Roman B, Ngo J, Bertomeu I, Obrador B: The use of indexes evaluating the adherence to the Mediterranean diet in epidemiological studies: a review. *Public Health Nutr* 9:132–146, 2006
- <sup>13</sup>Brill JB: The Mediterranean diet and your health. *Am J Lifestyle Med* 3:44–56, 2009
- <sup>14</sup>Sofi F, Cesari F, Abbate R, Gensini GF, Casini A: Adherence to Mediterranean diet and health status: meta-analysis. *BMJ* 337:a1344, 2008. (Electronically published; DOI: 10.1136/bmj.a1344)
- <sup>15</sup>Esposito K, Maiorino MI, Ceriello A, Giugliano D: Prevention and control of type 2 diabetes by Mediterranean diet: a systematic review. *Diabetes Res Clin Pract* 89:97–102, 2010
- <sup>16</sup>Risérus U, Willett WC, Hu FB: Dietary fats and prevention of type 2 diabetes. *Prog Lipid Res* 48:44–51, 2009
- <sup>17</sup>Shai I, Schwarzfuchs D, Henkin Y, Shahar DR, Witkow S, Greenberg I, Golan R, Fraser D, Bolotin A, Vardi H, Tangi-Rozental O, Zuk-Ramot R, Sarusi B, Brickner D, Schwartz Z, Sheiner E, Marko R, Katorza E, Thiery J, Fiedler GM, Blüher M, Stumvoll M, Stampfer MJ; Dietary Intervention Randomized Controlled Trial (DIRECT) Group: Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. *N Engl J Med* 359:229–241, 2008
- <sup>18</sup>Esposito K, Maiorino MI, Ciotola M, Di Palo C, Scognamiglio P, Gicchino M, Petrizzo M, Saccomanno F, Beneduce F, Ceriello A, Giugliano D: Effects of a Mediterranean-style diet on the need for antihyperglycemic drug therapy in patients with newly diagnosed type 2 diabetes: a randomized trial. *Ann Intern Med* 151:306–314, 2009
- <sup>19</sup>Elhayany A, Lustman A, Abel R, Attal-Singer J, Vinker S: A low carbohydrate Mediterranean diet improves cardiovascular risk factors and diabetes control among overweight patients with type 2 diabetes mellitus: a one year prospective randomized intervention study. *Diabetes Obes Metab* 12:204–209, 2009
- <sup>20</sup>Esposito K, Maiorino MI, Di Palo C, Giugliano D: Adherence to a Mediterranean diet and glycaemic control in type 2 diabetes mellitus. *Diabet Med* 26:900–907, 2009
- <sup>21</sup>Martínez-González MA, de la Fuente-Arrillaga C, Nunez-Cordoba JM, Basterra-Gortari FJ, Beunza JJ, Vazquez Z, Benito S, Tortosa A, Bes-Rastrollo M: Adherence to Mediterranean diet and risk of developing diabetes: prospective cohort study. *BMJ* 336:1348–1351, 2008
- <sup>22</sup>Salas-Salvadó J, Bulló M, Babio N, Martínez-González MA, Ibarrola-Jurado N, Basora J, Estruch R, Covas MI, Corella D, Arós F, Ruiz-Gutiérrez V, Ros E; for the PREDIMED Study investigators: Reduction in the incidence of type 2 diabetes with the Mediterranean diet: results of the PREDIMED-Reus Nutrition Intervention Randomized Trial. *Diabetes Care* Electronically published ahead of print on 13 October 2010 (DOI: 10.2337/dc10-1288)
- <sup>23</sup>Psaltopoulou T, Naska A, Orfanos P, Trichopoulos D, Moutokalakis T, Trichopoulou A: Olive oil, the Mediterranean diet, and arterial blood pressure: the Greek European Prospective Investigation into Cancer and Nutrition (EPIC) study. *Am J Clin Nutr* 80:1012–1018, 2004
- <sup>24</sup>Mena MP, Sacanella E, Vazquez-Agell M, Morales M, Fitó M, Escoda R, Serrano-Martínez M, Salas-Salvadó J, Benages N, Casas R, Lamuela-Raventós RM, Masanes F, Ros E, Estruch R: Inhibition of circulating immune cell activation: a molecular anti-inflammatory effect of the Mediterranean diet. *Am J Clin Nutr* 89:248–256, 2009
- <sup>25</sup>Ciccarone E, Di Castelnuovo A, Salcuni M, Siani A, Giacco A, Donati MB, De Gaetano G, Capani F, Iacoviello L; Gendiabe Investigators: A high-score Mediterranean dietary pattern is associated with a reduced risk of peripheral arterial disease in Italian patients with type 2 diabetes. *J Thromb Haemost* 1:1744–1752, 2003
- <sup>26</sup>Barzi F, Woodward M, Marfisi RM, Tavazzi L, Valagussa F, Marchioli R; GISSI-Prevenzione Investigators: Mediterranean diet and all-causes mortality after myocardial infarction: results from the GISSI-Prevenzione trial. *Eur J Clin Nutr* 57:604–611, 2003
- <sup>27</sup>Tuttle KR, Shuler LA, Packard DP, Milton JE, Daratha KB, Bibus DM, Short RA: Comparison of low-fat versus Mediterranean-style dietary intervention after first myocardial infarction (from The Heart Institute of Spokane Diet Intervention and Evaluation Trial). *Am J Cardiol* 101:1523–1530, 2008
- <sup>28</sup>Djuric Z, Vanloon G, Radakovich K, Dilaura NM, Heilbrun LK: Design of a Mediterranean exchange list diet implemented by telephone counseling. *J Am Diet Assoc* 108:2059–2065, 2008
- <sup>29</sup>Pereira, RF, Benson G, Boucher JL: The Mediterranean diet. *Diabetes Spectrum* 23:11–15, 2010

---

*Gretchen Benson, RD, LD, CDE, is the health care project manager, Raquel Franzini Pereira, MS, RD, LD, is the community project manager, and Jackie L. Boucher, MS, RD, LD, CDE, is vice president for education and a co-investigator for Hearts Beat Back: The Heart of New Ulm Project, at the Minneapolis Heart Institute Foundation in Minnesota. Ms. Boucher is also editor-in-chief of Diabetes Spectrum.*