

The Mediterranean Diet: Health Benefits, Utility, and Practicality

The Mediterranean Diet (MedDiet) has steadily gained scientific support in recent years. This diet originated in countries surrounding the Mediterranean Sea like Spain, France, Italy, Greece, and Turkey. The MedDiet includes a high intake of fruits, vegetables, whole grains, legumes, nuts, seeds, and olive oil; moderate consumption of fish and alcohol (typically red wine with meals); moderate to low consumption of dairy and poultry; and low consumption of processed and red meats (1). One striking aspect about the MedDiet is its high fat content, contributing about 40 percent of total kilocalories. Most of the fat in the MedDiet is in the form of monounsaturated fatty acids (MUFA) from virgin and extra virgin olive oil.

The MedDiet has been linked to numerous health benefits. Most notable is its association with decreased risk of developing cardiovascular disease (CVD), the number one cause of death world-wide (2). Additionally, the MedDiet has been associated with decreased incidence of type 2 diabetes and diagnostic factors for metabolic syndrome. Lastly, the MedDiet has demonstrated roles in weight maintenance and prevention of some types of cancers, Alzheimer's disease, and Parkinson's disease. Each of these health benefits is addressed below.

Cardiovascular Disease (CVD)

Increased adherence to the MedDiet is associated with a reduced risk for development of and mortality from CVD (2, 3). Since heart disease is classified as a low-grade inflammatory disease, interest in the anti-inflammatory effects of the MedDiet has grown. One of the largest current studies on the MedDiet is the PREDIMED Study (PREvencion con DIeta MEDiterranea), a multi-center, controlled, randomized, 5-year clinical trial designed to assess the MedDiet's effect on primary prevention of CVD in high cardiovascular-risk patients. Participants were assigned to one of three diets: a MedDiet high in virgin olive oil, a MedDiet

high in nuts, or a low-fat diet (control). This study encompasses numerous sub-studies, two of which are of particular interest here. One of these studies examined the short-term effect of the MedDiet on cardiovascular risk factors. The study revealed a positive correlation between MedDiet adherence and improved CVD risk factors including decreased insulin resistance, decreased blood pressure, and improved lipid profiles (2).

Since inflammation plays a key role in all stages of CVD development, reducing the number of circulating inflammatory markers appears to be essential in slowing its development and progression. In another PREDIMED trial conducted to observe the effect of the MedDiet on serum inflammatory markers, researchers observed that the two MedDiets proved to have anti-inflammatory effects while the low-fat diet led to an increase in these biomarkers. These anti-inflammatory effects included down-regulation of inflammatory biomarkers like C-reactive protein, interleukin-6, and adhesion molecules; the effects of the MedDiets were similar to the effect of drugs like ACE inhibitors and statins with proven anti-inflammatory properties, providing evidence that some dietary interventions may be as effective as some medications on critical pathways in the development of heart disease (2).

In the ATTICA study, researchers considered the effect of physical activity and MedDiet adherence on total antioxidant capacity (TAC), or the body's ability to interrupt the oxidative pathways in the progression of heart disease. This study showed that both high physical activity level and increased adherence to the MedDiet contributed to increased TAC and were even more effective when combined (4).

Type 2 Diabetes

It is well known that incidence of diabetes has paralleled rising obesity rates. In turn, one PREDIMED trial assessed the effects of the MedDiet on the incidence of diabetes (5). The same

diets discussed above were used, none of which restricted kilocalories. Additionally, increased physical activity was not suggested. After a median follow-up of 4 years, the two MedDiets combined resulted in a 52 percent lower incidence of diabetes. Considering that kilocalorie-restriction and increased physical activity are typical recommendations for preventing the progression of diabetes in patients with impaired glucose intolerance, these results were striking (5). Additional effects on glucose control were observed and are contained below in the discussion of the metabolic syndrome.

Metabolic Syndrome

Metabolic syndrome is a set of risk factors that increase the risk of developing chronic diseases. Currently, the criteria suggested by the National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATPIII) are used to diagnose metabolic syndrome. Specifically, at least three of the following characteristics must be present for its diagnosis: elevated waist circumference, elevated triglycerides, reduced HDL cholesterol (HDL-C), elevated blood pressure, and elevated fasting glucose.

Babio et al observed the beneficial effects of the MedDiet on the occurrence of metabolic syndrome in high-risk patients. The group with greatest MedDiet adherence experienced a 47 and 54 percent lower risk of low HDL-C and elevated triglycerides, respectively. Also, central adiposity was inversely associated with MedDiet adherence in men. Overall, MedDiet adherence had a more protective effect in men than in women (6).

Additional trials confirmed the inverse association between MedDiet adherence and metabolic syndrome. Goulet et al observed a negative correlation between MedDiet adherence and waist circumference (7). In the PREDIMED trials, both MedDiets were associated with increasing HDL-C and lowering blood pressure in hypertensive patients (2). Hypotensive effects

were similar to the effects of the unrestricted sodium Dietary Approaches to Stop Hypertension (DASH) diet but less effective than the low-sodium DASH diet (8, 9). Also, the MedDiet supplemented with olive oil was associated with decreased blood glucose, and both MedDiets were associated with reduced fasting insulin and insulin resistance. Additional hypolipidemic effects were identified in one PREDIMED trial, namely decreased LDL cholesterol (2).

Long-Term Weight Change

A positive energy balance in aging adults often leads to weight gain. This is due to a combination of food intake and physical inactivity and is an influential factor in the obesity epidemic. However, one study performed by Beunza et al showed that greater adherence to the MedDiet was associated with smaller weight gain during an average follow-up period of 5.7 years. These results were consistent in both the 2- and 4-year follow up periods (10). These results hold some promise for future weight maintenance counseling.

Cancer, Alzheimer's Disease, and Parkinson's Disease

Researchers have studied for years to understand the mechanisms behind three common and sometimes fatal diseases: cancer, Alzheimer's disease, and Parkinson's disease. The discovery of these mechanisms is critical for future research to determine preventative measures and treatments for these diseases. In the meantime, a meta-analysis of 12 studies examining the association between adherence to the MedDiet and health status revealed a 6 percent reduction in incidence and mortality from cancer and a 13 percent reduction in incidence of Alzheimer's disease and Parkinson's disease (3). A separate study concluded that increased MedDiet adherence reduced the risk of developing Alzheimer's disease by 40 percent (11). These are promising results for future prevention and treatment of these chronic diseases.

Discussion

In terms of the practicality and utility of the MedDiet, its usefulness, ease of incorporating, associated costs, and typical patient compliance should be addressed. The usefulness of the diet can be seen by its extensive health benefits, namely its associations with reduced risk of developing heart disease, type 2 diabetes, metabolic syndrome, and some cancers and degenerative diseases like Alzheimer's and Parkinson's diseases. Most of the current research on the MedDiet looks at the diet as a whole rather than its individual components, suggesting that this diet is most useful in chronic disease prevention when the foods are allowed to work synergistically (2).

Regardless of this exhaustive list of health benefits, it is highly unlikely that people world-wide will abandon their eating patterns once and for all and transition to a foreign dietary pattern. Fortunately though, the MedDiet consists of many components that can be gradually incorporated into dietary guidelines and the consumer's diet. Currently, the 2005 Dietary Guidelines for Americans encourage increased consumption of fruits, vegetables, and whole grains and moderate intake of meat. The next step in becoming more like the MedDiet recommendations could be to encourage greater consumption of MUFA-rich oils, with an emphasis on olive oil for its MUFA content and beneficial micro-components. Greater emphasis could also be put on consuming more nuts, legumes, and fish for protein and less red meat. Though it is doubtful that there will be a world-wide shift to follow the MedDiet, it is realistic that the United States could begin to recommend small changes that would shift the western diet to a more healthful one that imitates the MedDiet.

When considering the costs associated with the MedDiet, one must consider both short- and long-term costs. Increased adherence to the MedDiet is associated with increased total food

costs while the western dietary pattern (more red and processed meat, eggs, sauces, precooked food, fast-food, soft drinks, potatoes, and whole-fat dairy) is associated with lower total food costs (12). Though this is an obvious barrier for MedDiet implementation in some individuals, there are some ways to minimize and off-set this expense. For example, one could replace red meat with fish which are similar in price. For a less expensive option, the individual could purchase legumes and whole grains. If an individual is unable to purchase olive oil, they could opt to buy other MUFA-rich oils like canola and safflower oil, comparative in part to olive oil.

In addition to short-term costs, long-term costs should be considered as well. In 2005, one out of every two Americans was living with at least one chronic disease, each of which is linked to considerable healthcare costs (13). In 2007, diabetes alone was responsible for \$116 billion in direct medical expenditures, and cardiovascular disease and stroke, in 2009, consumed \$313.8 billion medical dollars (14, 15). Considering the extensive protective effects of the MedDiet against chronic diseases, there is an obvious long-term cost benefit that likely outweighs any short-term cost differences.

An individual's dietary compliance is often related to the satiety and palatability of a diet, both of which are advantages of the MedDiet. The frequent use of olive oil improves palatability of vegetables when used in salad dressings, sautéing, and stir-frying, and its high fat content increases satiety. This makes the MedDiet a more appealing dietary pattern to follow (2). Several intervention methods have proven effective in improving adherence to the MedDiet including individual counseling, group sessions, internet-based education, cooking classes, and printed handouts (16). Improved adherence was likely due to the personalized counseling and practical applications like recipes and cooking demonstrations.

In conclusion, one may ask if we should all be eating this way. In light of the overwhelming evidence of the MedDiet's health benefits, the easy answer is "yes". With this clear evidence and effective intervention strategies already mapped out, it seems the MedDiet is the way to go. One key issue, however, is the cost difference between the Western and Mediterranean diets. When weighed against the long-term savings in healthcare costs, however, the short-term costs lose significance. Also, there are some ways to curb the cost differences as aforementioned. Another issue is the fact that not all areas of the United States have ready access to fresh fish, a factor that is nonexistent in the Mediterranean region. A final concern is that additional research still needs to be conducted outside of the Mediterranean region in order to more clearly confirm that the beneficial effects of the diet can be extrapolated to other populations. In the meantime, it would be beneficial for individuals to increase intake of the MedDiet foods that have been proven to provide health benefits in other populations, particularly fruits, vegetables, and whole grains. Increasing caloric intake from these foods and decreasing intake from others would alone provide substantial health benefits and would be a great start to following in the footsteps of the Mediterranean.

REFERENCES

1. Serra-Majem L, Roman B, Estruch R. Scientific evidence of interventions using the Mediterranean diet: a systematic review. *Nutr Rev.* 2006;64:S27-S47.
2. Estruch R. Anti-inflammatory effects of the Mediterranean diet: the experience of the PREDIMED study. *Proc Nutr Soc.* 2010;69(3):333-340.
3. Sofi F, Cesari F, Abbate R, Gensini GF, Casini A. Adherence to Mediterranean diet and health status: meta-analysis. *BMJ.* 2008;337:a1344.
4. Kavouras SA, Panagiotakos DB, Pitsavos C, Chrysohoou C, Arnaoutis G, Skoumas Y, Stefanadis C. Physical activity and adherence to Mediterranean diet increase total antioxidant capacity: the ATTICA study. *Cardiol Res Pract.* 2010;2011:1-7.
5. Salas-Salvado J, Bullo M, Babio N, Martinez-Gonzalez MA, Ibarrola-Jurado N, Basora J, Estruch R, Covas MI, Corella D, Aros F, Ruiz-Gutierrez V, Ros E. Reduction in the incidence of type 2-diabetes with the Mediterranean diet: results of the PREDIMED-Reus nutrition intervention randomized trial. *Diabetes Care.* 2010 Oct [Epub ahead of print].
6. Babio N, Bullo M, Basora J, Martinez-Gonzalez MA, Fernandez-Ballart J, Marquez-Sandoval F, Molina C, Salas-Salvado J. Adherence to the Mediterranean diet and risk of metabolic syndrome and its components. *Nutr Metab Cardiovasc Dis.* 2009;19(8):563-570.
7. Goulet J, Lapointe A, Lamarche B, Lemieux S. Effect of a nutritional intervention promoting the Mediterranean food pattern on anthropometric profile in healthy women from the Quebec city metropolitan area. *Eur J Clin Nutr.* 2007;61(11):1293-1300.
8. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, Bray GA, Vogt TM, Cutler JA, Windhauser MM, Lin PH, Karanja N. A clinical trial of the effect of dietary patterns on blood pressure. *N Engl J Med.* 1997;336(16):1117-1124.
9. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, Obarzanek E, Conlin PR, Miller ER 3rd, Simons-Morton DG, Karanja N, Lin PH. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. *N Engl J Med.* 2001;344(1):3-10.
10. Beunza JJ, Toledo E, Hu FB, Bes-Rastrollo M, Serrano-Martinez M, Sanchez-Villegas A, Martinez JA, Martinez-Gonzales MA. Adherence to the Mediterranean diet, long-term weight change, and incident overweight or obesity: the Seguimiento Universidad de Navarra (SUN) cohort. *Am J Clin Nutr.* 2010;92(6):1484-1493.
11. Scarmeas N, Stern Y, Tang MX, Mayeux R, Luchsinger JA. Mediterranean diet and risk for Alzheimer's disease. *Ann Neurol.* 2006;59(6):912-921.

12. Lopez CN, Martinez-Gonzales MA, Sanchez-Villegas A, Alonso A, Pimenta AM, Bes-Rastrollo M. Costs of Mediterranean and western dietary patterns in a Spanish cohort and their relationship with prospective weight change. *J Epidemiol Community Health*. 2009;63(11):920-927.
13. Wu SY, Green A. *Projection of Chronic Illness Prevalence and Cost Inflation*. Santa Monica, Calif: RAND Health; 2000.
14. American Diabetes Association. Economic costs of diabetes in the U.S. In 2007. *Diabetes Care*. 2008;31(3):596-615.
15. Lloyd-Jones D, Adams R, Carnethon M, DeSimon G, Gerguson TB, Flegal K, Ford E, Furie K, Go A, Greenlund K, Haase N, Hailpern S, Ho M, Howard V, Kissela B, Kittner S, Lackland D, Lisabeth L, Marelli A, McDermott M, Meigs J, Mozaffarian D, Nichol G, O'Donnell C, Roger V, Rosamond W, Sacco R, Sorlie P, Stafford R, Steinberger J, Thom T, Wasserthiel-Smoller S, Wong N, Wylie-Rosett J, Hong Y. Heart disease and stroke statistics 2009 update. *Circulation*. 2009;119(3):e21-181.
16. Piscopo S. The Mediterranean diet as a nutrition education, health promotion and disease prevention tool. *Public Health Nutr*. 2009;12(9A):1648-1655.