



The Mediterranean Diet: An Update

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Abstract

In this short communication, attempts have been made to provide an update on the health benefits of the Mediterranean diet. A historical view as well as current evidence on the impact of such diet and lifestyle on a number of chronic disorders including cardiovascular abnormalities, weight management, cancer prevention, nervous system disorders and others has been summarized and discussed.

Keywords: Mediterranean Diet; Cardiovascular disease; Lifestyle; Physical activity; Cancer; Nervous system

Introduction

It has now been several decades that the principles and potential health benefits of the Mediterranean Diet have been documented [1]; however, the world scientific community still awaits a universally-agreed definition of this diet [2]. Although it is called a diet, in principle, it is a lifestyle emphasizing on a variety of dietary intakes, physical activities, peaceful meal environment, moderate alcohol consumption and low-stress life. This “old-fashion” diet seems to have all components of currently-recommended dietary plans for promoting quality of human life [3-6]. The Mediterranean Diet largely consists of fruits, vegetables, and whole grain products; a food pyramid has been suggested to include dietary intakes and lifestyle [7]. This recommended pyramid contains the following: a) plenty of water, b) with every main meal an intake of 1-2 servings of fruits, 2 or more servings of vegetables and 1-2 servings of whole grain products, c) every day intakes of 1-2 servings of olives, nuts and seeds, plus 2-3 servings of dairy products (low-fat dairy preferred), and 2-4 servings of olive oil as well as herb spices including garlic and onions (less salt); c) for every week 1-2 servings of poultry, 2 or more servings of fish and shellfish, 2 or more servings of legumes, 2-4 servings of eggs, less than 2 servings of red meat, less than 1 servings of processed meat and less than 3 servings of white bread or white pasta [7]. These dietary recommendations are further supplemented with advice on wine in moderation, moderate serving sizes, performing physical activities, and considering seasonality, conviviality, and local products.

As noted above, among many sources of dietary proteins, consumption of fish and poultry is more desirable than consumption of red meat and processed meat products. Dietary fat consumption mainly consists of olive oil which contains a large amount of the mono-unsaturated fatty acid oleic acid, while the amount of saturated fat is minimal [8]. Thus, such “healthy” oil plus complex carbohydrates (mainly from potatoes and whole grain products) and other dietary ingredients such as nuts, and fish are the main sources of energy intake [9]. Because of these features, the Mediterranean Diet was originally considered to protect against cardiovascular disorders [9-11]. However, additional studies revealed significant benefits to the physiologic function of other systems and organs as outlined below.

Cardiovascular System

Cardiovascular diseases including coronary heart disease, hypertension, stroke and other forms are still among the leading causes of morbidity and mortality worldwide. Among modifiable risk factors for such abnormalities include high consumption of saturated and industrially-produced Trans fat, sedentary lifestyle, high sodium intakes, and low dietary intakes of foods such as fruits, vegetables, and whole grain products. On the other hand, appropriate intakes of long-chain

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omega-3 fatty acids, moderate fish, and alcohol consumption, plus moderate levels of physical activities are associated with reduced risks for cardiovascular disorders. The Mediterranean Diet and lifestyle contains all of these factors for reducing cardiovascular risk [7]. In this regard, many epidemiological and clinical studies reported cardiovascular health benefits for the Mediterranean Diet in both primary and secondary prevention settings [12-16]. These studies reported a high degree of adherence and efficacy for the diet and lifestyle in reducing cardiovascular risk factors through beneficial changes in lipoprotein profile, antioxidant status, endothelial function, and others.

Weight Management

The World Health Organization (WHO) reports a globally increasing rate of obesity and overweight [17]. A BMI value of above 25 and 30 is considered as an index for diagnosis of overweight and obesity, respectively. It is generally believed that an increase in intakes of energy-dense foods and a lack of physical activity are linked to the incidence of obesity and overweight, and thereby a higher risk for non-communicable diseases such as cardiovascular disease, diabetes, and some types of cancer [17,18].

The Mediterranean dietary pattern features foods high in dietary fiber and low in energy [19]. Therefore, it is plausible to expect efficacy of such diets against overweight and obesity. In this regard, cohort studies suggested a preventive role for the Mediterranean Diet for weight management [19]. Additionally, higher adherence to the Mediterranean dietary pattern was inversely related to waist circumference, abdominal adiposity, and waist to hip ratio [19,20]. Furthermore, results from observational studies, clinical trials, and meta-analysis reports showed that higher adherence to the Mediterranean Diet was related to a lower BMI value with favorable effects on glycemic control [19-25]. Despite above-mentioned studies, a consensus does not exist on the efficacy of the Mediterranean Diet for prevention and treatment of obesity and overweight. One reason for that was reported to be high dropouts and short follow-ups in clinical studies [21]. Therefore, additional well-designed long-term clinical trials are needed to establish potential benefits of the Mediterranean Diet for prevention and treatment of obesity.

Cancer

According to a WHO report, cancer is one of the leading causes of death worldwide [26,27]. The most common cancers are breast, prostate, colorectal, and lung cancers [27]. Almost 30% of cancer risk factors are behavioral and preventable [26]. Obesity, lower intake of vegetable and fruits, sedentary lifestyle, high alcohol consumption, and smoking are among important modifiable risk factors for cancer [26]. Despite great advances in our understanding of cancer biology and production of some effective anti-cancer drugs and other approaches, our knowledge on the development and prevention of cancer is still limited.

The Mediterranean Diet is characterized by high intakes of fruits, vegetables, whole grains, healthy fat, and a balanced ratio of omega 6 and omega 3 essential fatty acids, and dietary antioxidants [27,28]. Previous work suggests anti-inflammatory effects for this diet which can influence cell proliferation, progression, and apoptosis [27]. Several studies reported that higher adherence to the Mediterranean Diet was inversely related to cancer incidence rate and cancer mortality rate [28-31]. A meta-analysis on previous cohort studies reported that a 2-point increase in adherence to the Mediterranean

Diet was associated with a 4% reduction in cancer incidence rate [32]. Although high alcohol consumption has been shown to increase the risk of some types of cancer [28,33], the moderate amounts of red wine with the Mediterranean Diet was not associated with overall increased risk of cancer [28]. This could be attributed to higher amounts of resveratrol [28] primarily in red wine. Another recently published article reported a negative association between the Mediterranean Diet containing extra-virgin olive oil and the invasive breast cancer risk among women with high cardiovascular risk [34].

Nervous System

Several factors can modulate brain function and integrity. Among them, intact and the fully functional vascular system plays a crucial role. Abnormalities in brain vascular function could be a consequence of cardiovascular disorders. One common problem is either hemorrhagic or ischemic stroke. Long-term consumption of the Mediterranean Diet could result in better brain function through improvements in cardiovascular system as mentioned above. In addition to this effect, a recent study reported that elderly people with a Mediterranean dietary habit retained their brain volume [35], suggesting a better cognitive function associated with components of the Mediterranean Diet [36]. In this particular study, an association between a low consumption of meat and meat products and a better performance on a 7-minute screening test and higher brain volume was found [36]. Another study found that a lack of adherence to the Mediterranean Diet over a 3-year interval in elderly subjects was predictive of total brain atrophy [37]. On the other hand, a high degree of adherence to the Mediterranean Diet was found to be associated with a thicker brain cortex in elderly subjects [38]. Furthermore, a structural brain study in a multiethnic cohort of 675 elderly subjects revealed that consumption of the Mediterranean Diet is associated with less brain atrophy, equivalent to an effect of 5-years of aging [39]. These beneficial effects of the Mediterranean Diet were thought to be linked with significant risk reduction for Alzheimer's disease development in elderly subjects over a course of 4 years follow-up [40]. A similar observation was reported in a recent study in which better cognitive function and lower dementia rates were found in elderly Greek who had higher adherence to the Mediterranean Diet [41]. Altogether, emerging strong evidence suggests that this diet is not only good for the heart but also good for the brain too.

Others

A literature search indicates direct or indirect beneficial effects of the Mediterranean Diet on a number of conditions, mainly due to the improvements in cardiovascular function. For example, a recent study reported that the Mediterranean Diet rich in extra virgin olive oil improved endothelial function in diabetic and pre-diabetic subjects [42]. In this regard, a recently published systemic review concluded that among several diets tested for efficacy on glycemic control in subjects with type-2 diabetes, the Mediterranean Diet was found to be the most efficacious at 80%, followed by the Palaeolithic diet at 71% and Vegetarian diet at 63% [43]. Other studies have reported that anti-inflammatory properties of the Mediterranean Diet may attenuate disease condition in patients with rheumatoid arthritis, and thereby improve quality of life [44,45]. Other studies report potential protective effects of the Mediterranean Diet against asthma and allergic reactions in children and those may not drink alcohol after children [46,47].

Closing Remarks

Once known as a dietary combat against cardiovascular diseases,

the Mediterranean Diet may be also associated with risk reductions for a number of chronic diseases including ischemic heart disease, stroke, cancer, obesity, inflammatory disorders and declines in brain function. A meta-analysis of over 1.5 million subjects concluded that the Mediterranean Diet was associated with 9% reduction in overall mortality, 9% reduction in cardiovascular disease mortality, 6% reductions in incidence or mortality from cancer, and 13% reduction in the incidence of Alzheimer's disease and Parkinson's disease [48]. All of these benefits can be attributed to its functional ingredients including oleic acid, antioxidant phytochemicals, complex carbohydrates as well as other features associated with this diet such as reduced red meat and processed meat intakes, limited dietary saturated fat, moderate alcohol consumption, moderate physical activities and emphasis on peaceful mealtime environment. Each of these components of the Mediterranean Diet alone or in combination has established health-promoting activities. Thus, regular consumption of such diet and adherence to the suggested lifestyle can increase the quality of life. Increasing quality of life means improvements in productivity, reductions in hospitalization and the savings of millions of dollars in health care spending. Thus, it is recommended that healthcare professionals and policymakers work together to promote consumption of such a well-rounded "healthy" diet and lifestyle in both developed and developing countries regardless of their geographic locations.

In conclusion, the so-called Mediterranean dietary habit is very easy to plan with a high compliance rate. It is applicable to all different segments of the population, except for suggested wine consumption in children. A majority of recommended dietary approaches for prevention of chronic diseases, for example, the Dash Diet, current recommendations of Canada's Food Guide, and the American Food Pyramid to a large extent seems to be in agreement with the principles of the Mediterranean Diet. The take-home message is that people should include in their daily eating plans adequate amounts of fruits and vegetables, whole grain products, health-promoting oils such as olive or canola oils, 2-fatty fish meals per week, more poultry meat and less red meat and limited amounts of processed meat products. Such an eating behavior must be accompanied by a low level of stress and enjoyable eating environment. As much as the diet and eating patterns are important, so are the social environment and appropriate amounts of physical activities. The combination of these healthy lifestyles assures the quality of life and reductions in the incidence of killing disorders such as heart attack and cancer.

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References

- Keys A, Menotti A, Karvonen MJ, Aravanis C, Blackburn H, Buzina R, et al. The diet and 15-year death rate in the seven countries study. *Am J Epidemiol.* 1986;124(6):903-15.
- Davis C, Bryan J, Hodgson J, Murphy K. Definition of the Mediterranean Diet; a literature review. *Nutrients.* 2015;7(11):9139-53.
- Eating Well With Canada's Food Guide.
- Australian Dietary Guidelines. National health and Medical Research Council.
- American Dietary Guidelines.
- Bach-Faig A, Berry EM, Lairon D, Reguant J, Trichopoulou A, Dernini S, et al. Mediterranean Diet Foundation Expert Group Mediterranean diet pyramid today science and cultural updates. *Public Health Nutr.* 2011;14(12A):2274-84.
- D'Alessandro A, De Pergola G. Mediterranean diet Pyramid: a proposal for Italian people. *Nutrients.* 2014;6(10):4302-16.
- Trichopoulou A, Corella D, Martinez-Gonzalez MA, Soriguer F, Ordovas JM. The Mediterranean Diet and cardiovascular epidemiology. *Nutr Rev.* 2006;64(4):S13-9.
- Fidanza F, Alberti A, Lanti M, Menotti A. Mediterranean Adequacy Index: correlation with 25-year mortality from coronary heart disease in the Seven Countries Study. *Nutr Metab Cardiovasc Dis.* 2004;14(5):254-8.
- Mancini M, Parillo M, Rivellesse A, Riccardi G. Nutrition and cardiovascular risk: the Mediterranean experience. *Acta Cardiol.* 1989;44(6):466-7.
- Sirtori CR, Tremoli E, Gatti E, Montanari G, Sirtori M, Colli S, et al. Controlled evaluation of fat intake in the Mediterranean diet: comparative activities of olive oil and corn oil on plasma lipids and platelets in high-risk patients. *Am J Clin Nutr.* 1986;44(5):635-42.
- Dinu M, Pagliai G, Casini A, Sofi F. Mediterranean diet and multiple health outcomes: an umbrella review of meta-analyses of observational studies and randomized trials. *Eur J Clin Nutr.* 2018;72(1):30-43.
- Estruch R, Ros E, Salas-Salvado J, Covas MI, Corella D, Aros F, et al. Primary prevention of cardiovascular disease with a Mediterranean diet. *N Engl J Med.* 2013;368(14):1279-90.
- Fung TT, Rexrode KM, Mantzoros CS, Manson JE, Willett WC, Hu FB. Mediterranean diet and incidence of and mortality from coronary heart disease and stroke in women. *Circulation.* 2009;119(8):1093-100.
- Gardener H, Wright CB, Gu Y, Demmer RT, Boden-Albala B, Elkind MS, et al. Mediterranean-style diet and risk of ischemic stroke, myocardial infarction, and vascular death: the Northern Manhattan Study. *Am J Clin Nutr.* 2011;94(6):1458-64.
- Kastorini CM, Milionis HJ, Ioannidi A, Kalantzi K, Nikolaou V, Vemmos KN, et al. Adherence to the Mediterranean diet in relation to acute coronary syndrome or stroke nonfatal events: a comparative analysis of a case/control study. *Am Heart J.* 2011;162(4):717-24.
- World Health Organization. WHO | Obesity and overweight [Internet]. WHO. World Health Organization; 2018.
- Sofi F, Macchi C, Abbate R, Gensini GF, Casini A. Mediterranean diet and health. *BioFactors.* 2013;39:335-42.
- Romaguera D, Norat T, Mouw T, May AM, Bamia C, Slimani N, et al. Adherence to the Mediterranean Diet Is Associated with Lower Abdominal Adiposity in European Men and Women. *J Nutr.* 2009;139(9):1728-37.
- Panagiotakos DB, Chrysohoou C, Pitsavos C, Stefanadis C. Association between the prevalence of obesity and adherence to the Mediterranean diet: the ATTICA study. *Nutrition.* 2006;22(5):449-56.
- Shai I, Schwarzfuchs D, Henkin Y, Shahar DR, Witkow S, Greenberg I, et al. Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet. *N Engl J Med.* 2008;359:229-41.
- Esposito K, Kastorini CM, Panagiotakos DB, Giugliano D. Mediterranean Diet and Weight Loss: Meta-Analysis of Randomized Controlled Trials. *Metab Syndr Relat Disord.* 2011;9(1):1-12.
- Buckland G, Bach A, Serra-Majem L. Obesity and the Mediterranean diet: a systematic review of observational and intervention studies. *Obes Rev.* 2008;9(6):582-93.
- Panagiotakos DB, Polystipioti A, Papairakleous N, Polychronopoulos E. Long-term adoption of a Mediterranean diet is associated with a better health status in elderly people; a cross-sectional survey in Cyprus. *Asia Pac J Clin Nutr.* 2007;16(2):331-7.

25. Schröder H, Marrugat J, Vila J, Covas MI, Elosua R. Adherence to the traditional mediterranean diet is inversely associated with body mass index and obesity in a spanish population. *J Nutr.* 2004;134(12):3355-61.
26. World Health Organization. WHO | Cancer. WHO. World Health Organization; 2018.
27. Schwingshackl L, Hoffmann G. Adherence to Mediterranean diet and risk of cancer: A systematic review and meta-analysis of observational studies. *Int J Cancer.* 2014;135(8):1884-97.
28. Giacosa A, Barale R, Bavaresco L, Gatenby P, Gerbi V, Janssens J, et al. Cancer prevention in Europe. *Eur J Cancer Prev.* 2013;22:90-5.
29. Benetou V, Trichopoulou A, Orfanos P, Naska A, Lagiou P, Boffetta P, et al. Conformity to traditional Mediterranean diet and cancer incidence: the Greek EPIC cohort. *Br J Cancer.* 2008;99(1):191-5.
30. Bosetti C, Gallus S, Trichopoulou A, Talamini R, Franceschi S, Negri E, et al. Influence of the Mediterranean diet on the risk of cancers of the upper aerodigestive tract. *Cancer Epidemiol Biomarkers Prev.* 2003;12(10):1091-4.
31. Mitrou PN, Kipnis V, Thiébaud ACM, Reedy J, Subar AF, Wirfält E, et al. Mediterranean Dietary Pattern and Prediction of All-Cause Mortality in a US Population: results from the NIH-AARP Diet and Health Study. *Arch Intern Med.* 2007;167(22):2461-8.
32. Sofi F, Macchi C, Abbate R, Gensini GF, Casini A. Mediterranean diet and health status: an updated meta-analysis and a proposal for a literature-based adherence score. *Public Health Nutr.* 2014;17(12):2769-82.
33. American Cancer Society. Alcohol and Cancer Risk Fact Sheet - National Cancer Institute.
34. Toledo E, Salas-Salvador J, Donat-Vargas C, Buil-Cosiales P, Estruch R, Ros E, et al. Mediterranean Diet and Invasive Breast Cancer Risk Among Women at High Cardiovascular Risk in the PREDIMED Trial: A Randomized Clinical Trial. *JAMA Intern Med.* 2015;175(11):1752-60.
35. Torjesen I. Elderly followers of Mediterranean diet retain brain volume better, study finds. *BMJ.* 2017; 356:j49.
36. Titova OE, Ax E, Brooks SJ, Sjögren P, Cederholm T, Kilander L, et al. Mediterranean diet habits in older individuals: associations with cognitive functioning and brain volumes. *Exp Gerontol.* 2013;48(12):1443-8.
37. Luciano M, Corley J, Cox SR, Valdés Hernández MC, Craig LC, Dickie DA, et al. Mediterranean-type diet and brain structural change from 73 to 76 years in a Scottish cohort. *Neurology.* 2017;88(5):449-55.
38. Staubo SC, Aakre JA, Vemuri P, Syrjanen JA, Mielke MM, Geda YE, et al. Mediterranean diet, micronutrients and macronutrients, and MRI measures of cortical thickness. *Alzheimers Dement.* 2017;13(2):168-77.
39. Gu Y, Brickman AM, Stern Y, Habeck CG, Razlighi QR, Luchsinger JA, et al. Mediterranean diet and brain structure in a multiethnic elderly cohort. *Neurology.* 2015;85(20):1744-51.
40. Scarmeas N, Stern Y, Tang MX, Mayeux R, Luchsinger JA. Mediterranean diet and risk for Alzheimer's disease. *Ann Neurol.* 2006;59(6):912-21.
41. Anastasiou CA, Yannakoulia M, Kosmidis MH, Dardiotis E, Hadjigeorgiou GM, Sakka P, et al. Mediterranean diet and cognitive health: Initial results from the Hellenic Longitudinal Investigation of Ageing and Diet. *PLoS One.* 2017;12(8): e0182048.
42. Torres-Peña JD, Garcia-Rios A, Delgado-Casado N, Gomez-Luna P, Alcalá-Díaz JF, Yubero-Serrano EM, et al. Mediterranean diet improves endothelial function in patients with diabetes and prediabetes: A report from the CORDIOPREV study. *Atherosclerosis.* 2018;269:50-6.
43. Schwingshackl L, Chaimani A, Hoffmann G, Schwedhelm C, Boeing H. A network meta-analysis on the comparative efficacy of different dietary approaches on glycaemic control in patients with type 2 diabetes mellitus. *Eur J Epidemiol.* 2018;33(2):157-70.
44. Matsumoto Y, Sugioka Y, Tada M, Okano T, Mamoto K, Inui K, et al. Monounsaturated fatty acids might be key factors in the Mediterranean diet that suppress rheumatoid arthritis disease activity: The Tomorrow study. 2018;37(2):675-80.
45. Veronese N, Stubbs B, Noale M, Solmi M, Luchini C, Maggi S. Adherence to the Mediterranean diet is associated with better quality of life: data from the Osteoarthritis Initiative. *Am J Clin Nutr.* 2016 ;104(5):1403-9.
46. Castro-Rodriguez JA, Garcia-Marcos L. What Are the Effects of a Mediterranean Diet on Allergies and Asthma in Children? *Front Pediatr.* 2017;5:72.
47. Papamichael MM, Itsiopoulos C, Susanto NH, Erbas B. Does adherence to the Mediterranean dietary pattern reduce asthma symptoms in children? A systematic review of observational studies. *Public Health Nutr.* 2017;20(15):2722-34.
48. Sofi F, Cesari F, Abbate R, Gensini GF, Casini A. Adherence to Mediterranean diet and health status: meta-analysis. *BMJ.* 2008;337:a1344.