Mediterranean diet: from a healthy diet to a sustainable dietary pattern

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The notion of the Mediterranean diet has undergone a progressive evolution over the past 60 years, from a healthy dietary pattern to a sustainable dietary pattern, in which nutrition, food, cultures, people, environment, and sustainability all interact into a new model of a sustainable diet. An overview of the historical antecedents and recent increased interest in the Mediterranean diet is presented and challenges related to how to improve the sustainability of the Mediterranean diet are identified. Despite its increasing popularity worldwide, adherence to the Mediterranean diet model is decreasing for multifactorial influences – life styles changes, food globalization, economic, and socio-cultural factors. These changes pose serious threats to the preservation and transmission of the Mediterranean diet heritage to present and future generations. Today’s challenge is to reverse such trends. A greater focus on the Mediterranean diet’s potential as a sustainable dietary pattern, instead than just on its well-documented healthy benefits, can contribute to its enhancement. More cross-disciplinary studies on environmental, economic and socio-cultural, and sustainability dimensions of the Mediterranean diet are foreseen as a critical need.

Keywords: Mediterranean diet, sustainable diets, sustainable food systems, food consumption, food cultures, intangible cultural heritage

Introduction

Mediterranean dietary patterns have developed over the past 5000 or more years spreading from the Fertile Crescent (1) and influenced by the conquests of many different civilizations, the consolidated dietary rules of the three main monotheistic religions (Judaism, Christianity, and Islam), and continuous interactions, additions, and exchanges inside and outside the region. As a result, the Mediterranean diet is an expression of the different food cultures present in the Mediterranean region, with diverse food consumption and production patterns, in continuous evolution representing the particular historical and environmental mosaic that is the Mediterranean (2).

It must be emphasized that there is not one single Mediterranean diet, but rather a number of variations on a basic theme adapted to individual country’s cultures. Therefore, the Mediterranean diet is more than just a defined diet, but it represents the plurality of various cultural expressions of different Mediterranean food cultures and lifestyles.

The term “Mediterranean diet” implies the existence of some common dietary characteristics in Mediterranean countries such as: high amounts of olive oil and olives, fruits, vegetables, cereals (mostly unrefined), legumes, and nuts, moderate amounts of fish and dairy products, and low quantities of meat and meat products. Wine in moderation is acceptable when it is not contradictory to religious and social norms (3–5).
The Mediterranean diet has been well-characterized scientifically following the pioneering Seven Countries Study conducted by Ancel Keys in the 60s (6). Since then, the Mediterranean diet has been widely studied and reported to be a model of healthy eating associated with significant nutritional and health benefits (7–14).

Moving Away from the Traditional Mediterranean Diet Model

The Mediterranean area could be described as passing through a “nutritional transition” in which problems of under-nutrition coexist with overweight, obesity, and food-related chronic diseases (15). Under-nutrition is still significant in the South of the Mediterranean: 9.2 million people in 2001–03, 3.9% of the population of the zone, compared with 7.3 million people in 1990–92, 3.8% of the population (16). In 2011, reported rates for overweight and obesity were as follows: 54.4 and 21.3% in Albania; 45.5 and 16.0% in Algeria; 67.9 and 33.1% in Egypt; 50.7 and 18.2% in France; 53.7 and 20.1% in Greece; 54.1 and 19.8% in Italy; 61.8 and 27.4% in Lebanon; 64.3 and 28.8% in Malta; 46.8 and 16.4% in Morocco; 59.1 and 24.0% in Portugal; 62.0 and 26.6% in Spain; 53.7 and 22.3% in Tunisia; and 61.9 and 27.8% in Turkey (17).

Investigations in the early 90s already showed that dietary patterns throughout the Mediterranean countries were increasingly moving away (18–20) from those reported in the 60s. Thus, already in 1995, the Mediterranean diet was considered to be at risk of becoming an “endangered species” (21). Moreover, more recent data have confirmed that in many Mediterranean countries the loss of adherence to the Mediterranean diet is continuing and increasing (22–30), linked also to the current economic downturn (31).

Such a decline in the Mediterranean’s healthy diet patterns was already predicted in 2005 in the Mediterranean Strategy for Sustainable Development report, issued by the United Nations Environment Program, as follows: “Mediterranean agricultural and rural models, which are at the origins of Mediterranean identity, are under increasing threat from the predominance of imported consumption patterns. This trend is illustrated in particular by the decline of the Mediterranean dietary model despite the recognized positive effects on health” (32).

Since the early 90s, the healthy Mediterranean diet pattern has been popularized using a pyramid representation as a dietary guideline, in which were highlighted graphically the foods to consume daily, weekly, or less frequently (3). Several dietary guidelines for specific Mediterranean populations have been also developed, associated with a pyramidal representation, such as for the Spanish (33), Greek (34), and Italian populations (35, 36). Since then, various dietary scores of adherence to the Mediterranean diet have been published and extensively reviewed in Ref. (37–41).

In 2009 and 2010, through an international scientific consensus process, a new revised Mediterranean diet pyramid (Figure 1) was developed to be adapted to contemporary lifestyles. The new revised Mediterranean diet pyramid was conceived as a simplified main frame to be adapted to different countries specific variations related to the various geographical, socio-economic, and cultural contexts of the contemporary Mediterranean lifestyle, taking into account also their different portions and serving sizes. Daily main meals were highlighted; the concept of frugality and moderation was more emphasized because of the major public health challenge of obesity. In this revised Mediterranean diet pyramid, for the first time, nutrition, eco-friendly products, biodiversity, fruits, and vegetables with a variety of colors, local food production, and conviviality, were brought together with the concept of sustainability (5, 42).

An Overview of the Themes Surrounding the Mediterranean Diet

Historically, starting from the 1960s, the Mediterranean diet began to be studied as a model of a healthy diet with reduced morbidity and mortality.

Then, in the early 1990s, the Mediterranean diet as a plant-centered diet, consequently lowered demand on soil, water, and energy resources, began to be researched by Joan Dye Gussow as a sustainable dietary pattern, which also considers the overall impact on the ecosystem (43).

In the last decade, the Mediterranean diet has become the object of increasing studies on its environmental sustainability, because of its mainly plant-based dietary pattern and its lower greenhouse gas emissions and lower water footprints, when compared to current Western dietary patterns (44–55).

In 2009, the international conference “The Mediterranean diet as a sustainable diet model” was organized in Parma, Italy, by the International Interuniversity Studies Center on Mediterranean Food Cultures (CIISCAM), with the technical collaboration of FAO, the Italian National Institute of Food and Nutrition (INRAN), and the International Center for Advanced Mediterranean Agronomic Studies (CIHEAM) of Bari. The CIHEAM is an intergovernmental organization composed of ministers of agriculture of its 13 member states. At this conference, the Mediterranean diet was analyzed as a sustainable diet model, because of its nutritional, environmental, economic, and socio-cultural dimensions at the core of the sustainability rationale (56). On this occasion, an international consensus was also reached on a new revised Mediterranean diet pyramid in which, for the first time, biodiversity and eco-friendly products, with a lower impact on the environment, were inserted together with main Mediterranean diet characteristic foods (5, 42).

As a follow up to it, in 2010, FAO and Bioversity International organized in collaboration with CIHEAM-Bari and INRAN, an international scientific symposium on “biodiversity and sustainable diets,” in which a consensus position was reached on a definition of “sustainable diets,” as follows: “Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources” (57). Within this definition, on this occasion, the Mediterranean diet was acknowledged as a sustainable diet example. Therefore, FAO and CIHEAM-Bari started a joint collaboration on the Mediterranean diet as a case study on which to develop and validate methods and indicators for the assessment of the sustainability of diets and food consumption.
patterns in the Mediterranean area. In line with the definition, four main thematic areas were identified: (1) nutrition, health, and lifestyle; (2) environment including agro-biodiversity; (3) economy; (4) society and culture (58, 59).

At the end of 2010, the Mediterranean diet was inscribed in the UNESCO Representative List of the Intangible Cultural Heritage of Humanity, and described as follows: “The Mediterranean Diet – derived from the Greek word diáita, way of life – is the set of skills, knowledge, rituals, symbols, and traditions, ranging from the landscape to the table, which in the Mediterranean basin concerns the crops, harvesting, picking, fishing, animal husbandry, conservation, processing, cooking, and particularly sharing and consuming of food” (60) (Figure 2). This UNESCO acknowledgment highlighted that the Mediterranean diet notion was encompassing a social cultural expression of the different food cultures of the Mediterranean and the importance of the Mediterranean diet was not just in its specific foods and nutrients, but in the way in which its characteristic foods were produced, cooked, and eaten.

From 2011 to 2012, as outcome of the FAO/CIHEAM case study on the sustainability of the Mediterranean diet, through a participatory joint process, conducted with the FAO/UNEP Sustainable Food Systems (SFSs) Program in collaboration with the Forum on Mediterranean Food Cultures, CIISCAM/Sapienza University of Rome, ENEA, CNR, INRAN, Bioversity International, and WWF-Italy, a first outline of a methodological approach was developed for the FAO/CIHEAM discussion paper “Toward the Development of Guidelines for Improving the Sustainability of Diets and Food Consumption Patterns in the Mediterranean Area” and presented within the international seminar “The Sustainability of Food Systems in the Mediterranean Area,” jointly organized on the occasion of the 9th Meeting of the CIHEAM Ministers of Agriculture, held in 2012 in Malta (58). This discussion paper also provided a first list of potential sustainability indicators, based on existing data source, taking into account priority challenges (58, 59). In the final CIHEAM Ministers’ declaration, the role of the Mediterranean diet was underlined "as a driver of SFS within the strategies of regional development and on that of traditional local products, since quantitative food security must also be complemented by qualitative approaches," and it was also recommended to support the implementation of the outcomes of the FAO/CIHEAM International Seminar (58).
As a follow up, CIHEAM-Bari started in 2013 a pilot project on “Evaluation and valorization of the sustainability of quality products of Apulia, Italy.” Its objective was to apply the methodological approach jointly developed with FAO to a well-defined territorial context, such as the Apulia region (61), to add together, environmental, economic, nutritional-health, and socio-cultural sustainable values to local quality typical products, which are also the cornerstone of the regional Mediterranean diet and food system. This methodological approach was then further developed in a White Paper 5 “Mediterranean food consumption patterns: diet, environment, society, economy, and health” prepared by CIHEAM-Bari and FAO-SFS Program for Feeding Knowledge project in view of EXPO 2015 in Milan (62).

**Discussion**

One of the most important challenges faced especially by southern and eastern Mediterranean countries is food and nutrition security (63), in which problems of under-nutrition coexist, within a “nutritional transition” process, with overweight, obesity, and food-related chronic diseases (15). Population growth, globalization, urbanization, and socio-economic factors are causing changes in diets and consumption patterns in the Mediterranean region and southern European countries (64–68).

Today, a main concern for the Mediterranean food and agricultural sector is also to conserve natural resources for future generations while providing simultaneously enough food, in quantity and quality, to meet the nutritional needs of a growing population. Therefore, changes toward optimizing both food consumption and food production are foreseen to ensure more SFSs and contribute to achieve food and nutrition security in the Mediterranean region (62).

Food security, nutrition, and sustainability have been increasingly discussed in the same context (69–72). The High Level Panel of Experts on Food Security and Nutrition (HLPE) has recently provided the following definitions for SFS and for food system:

“**A SFS is a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised; A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation, and consumption of food and the outputs of these activities, including socio-economic and environmental outcomes**” (72).

Food systems around the world are changing rapidly, with profound implications for diets and food consumption outcomes. Food consumption is variably affected by a wide range of factors including food availability, food accessibility, and food choices, which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing, and consumer attitude (73, 74).

Consumer choice can play a leading role to orient food production toward sustainability, by selecting certain types of products according to their geographic origin, production process, thereby creating value especially for small producers. “Sustainable consumption and production” recognizes the role of consumers to promote sustainability, and sustainable production, by their consumption choices. To increase the sustainability of food systems, both production and consumption and supply and demand, have to be considered (75).

Food consumption trends and patterns have been considered among the most important drivers of environmental pressures (74, 76). Sustainable diets are considered those diets that have “low environmental impact and are respectful of biodiversity while optimizing natural and human resources” (57). The Mediterranean diet model in many studies has been appreciated to have a lower environmental impact, mainly due to its consumption of more plant-derived products and less animal products, with respect to other current dietary patterns (44–54). A recent study has shown that a better adherence of the Spanish population toward the Mediterranean diet pattern would have reduced greenhouse gas
emissions, land use, and energy consumption and to a lower extent water consumption (55).

Some studies have shown that foods with lower greenhouse gas emissions do not have always also higher nutritional values (77, 78), and more studies are also needed to assess the relation between the nutrient adequacy of individual foods and total diets in relation to multiple sustainability assessments (79).

The assessment of the sustainability of the Mediterranean diet in different countries requires also to evaluate interactions and correlations, direct and indirect, between nutrition/health and environmental indicators and indicators related to the socio-cultural and economic dimensions of sustainability. Because all current adherence scores refer only to the nutritional and health cultural and economic dimensions of sustainability. Because all current adherence scores refer only to the nutritional and health benefits of the traditional Mediterranean diet model (37–41), there is also a need to develop and validate new comprehensive adherence scores for the Mediterranean diet model as a sustainable dietary pattern for the contemporary times. The centrality of the individual, the consumer, should be also considered in the assessment of the sustainability of the Mediterranean diet, in spite of lack of data availability on individuals in most of the southern and eastern Mediterranean countries.

**Conclusion**

Numerous questions still need to be addressed on the broader concept of the sustainability of the Mediterranean diet, particularly after its acknowledgment by UNESCO as an intangible cultural heritage, with a need for providing more assessments of its socio-cultural and economic sustainability, which are still lacking.

**Food** plays a central role in the social and cultural life of the Mediterranean area. In this context, the Mediterranean diet is a complex web of inter-related cultural aspects, and it must always be considered as a part of significant social and cultural inter-dependent Mediterranean food systems, and never as an independent item (80, 81). Therefore, a SFSs approach, in which also its socio-cultural and economic benefits are highlighted together with the well-appreciated healthy and environmental ones, can contribute to the enhancement of the Mediterranean diet.

More interdisciplinary studies and country-based approaches need to be developed, in the context of Mediterranean SFSs improvement, to better understand potential interactions between the Mediterranean diet, and the sustainability of the food consumption and production of its characteristic foods.

The ongoing CIHEAM/FAO case study, as part of the further development of the FAO/UNEP SFSs program, within the 10-Year Framework of Programs on Sustainable Consumption and Production (82), will provide more understanding on linkages between the Mediterranean diet and Mediterranean food systems. This shift of interest on the Mediterranean diet, from a healthy diet to a sustainable dietary pattern, would also contribute to the improvement of the sustainability of Mediterranean food systems and food security and nutrition in the Mediterranean area.

A greater focus on the Mediterranean diet's potential as a sustainable dietary pattern would be beneficial for its revitalization. Therefore, more cross-cutting studies through the nutrition/health, environmental, economic, and socio-cultural sustainability dimensions of the Mediterranean diet are foreseen as a critical need for it.

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