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Original article

Mediterranean Diet as a model of sustainable, resilient and healthy diet

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Abstract. A sustainable diet is characterized by food security and accessibility; healthy food, respect for environment and biodiversity, fair trade, locality/Seasonality and protection of culture, heritage, and skills.

Being in line with these points, the Mediterranean Diet (MedD) has been largely recognized as sustainable and healthy. As a matter of fact, the MedD is built on the consumption of olive oil, cereals, fruit and vegetables, a moderate amount of fish, dairy and meat, and many condiments and spices, occasionally accompanied by wine and coffee. In addition, the MedD promotes social interaction, it has given rise to a considerable body of cultural habits, it is deeply rooted in local territory, it protects biodiversity, and it ensures the conservation and development of traditional activities. In conclusion Mediterranean diet promotes not only disease prevention but also a more advantageous and resilient economy.

Key words: Mediterranean Diet, sustainability, resilience, pyramids

Introduction

Between 1940 and 1970, a comparable demographic explosion propelled the so-called "Green Revolution": the farming of mainstream crops (corn, rice, wheat) augmented due to the massive employment of fertilizers and pesticides; large-scale agriculture consequently increased the use of soil, water, and ecological footprint; and global corporations started exploiting advertisement to influence eating habits of consumers and worldwide supply chain to bring any type of food, regardless of seasonality, to the market. As a consequence, consumers have been incentivized towards highly polluting and lowly nutritive food, instead of healthier local products. While availability of food has increased, the quality of eating habits has decreased, increasing the incidence of malnutrition caused by lack of micronutrients. [1]

Nutritional deficit worsens the lives of 2 billion people all over the world as it decreases life expectancy, quality of life; and it is both responsible for the deaths of 36 million underweight individuals and 29 million obese individuals every year. Promoting healthy and sustainable diets is the first step to decrease malnutrition and cardiovascular risk burden [1, 2].

Considering that by 2050 9.8 billion people will inhabit our planet, encouraging sustainable diets is a critical challenge for our society. Diets are considered sustainable if they are able to reduce the carbon footprint, protect biodiversity, enhance the management of natural resources, be healthy, and affordable for consumers. The demographic increase will be followed by a 56 % increment in food demand. Consequently, this will have a critical environmental impact due to increases in the production of greenhouse gasses, exploitation of soil and water, and loss of biodiversity.

Within the international debate on a shift towards more sustainable food systems and diets, interest in the Mediterranean diet (MedD) as a model of a sustainable dietary pattern has increased. [1,3,4] In 2009, an international conference on 'The Mediterranean Diet as a Sustainable Diet Model' was organized to present the Mediterranean diet as a sustainable dietary pattern. In the meantime an update of the Mediterranean diet pyramid in the light of current lifestyle changes, with serving sizes based on local habits, as well as with new characteristic elements such as biodiversity, seasonality, culinary activities, traditional, local and eco-friendly food products, conviviality, adequate rest and regular physical activity have been suggested.[5,6,7] In conclusion the expert panel stated that the MedD were largely recognized as a sustainable and healthy diet. (Table 1)

Table 1. WHO and FAO Definition of characteristics of a diet

Sustainable	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
Resilient	Resilience is the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses – such as earthquakes, drought or violent conflict – without compromising their long-term prospects
Healthy	A Diet that protects against many chronic noncommunicable diseases, such as heart disease, diabetes and cancer. Eating a variety of foods and consuming less salt, sugars and saturated and industrially-produced trans-fats, are mandatory for healthy diet. A healthy diet comprises a combination of different foods. These include: o Staples like cereals (wheat, barley, rye, maize or rice) or starchy tubers or roots (potato, yam, taro or cassava). o Legumes (lentils and beans). o Fruit and vegetables. o Foods from animal sources (meat, fish, eggs and milk)

Mediterranean diet is a sustainable diet

According to the definition agreed by FAO and Biodiversity International [8]

> *"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"*

Starting from this definition, Lairon [9] developed a 6-factor model to further delineate the key components of a sustainable diet:

1. Food security and accessibility
2. Healthy food
3. Respect for environment and biodiversity
4. Fair trade
5. Locality/Seasonality
6. Protection of culture, heritage, and skills

Being in line with these points, the MedD has been largely recognized as sustainable [1,5,10]. As a matter of fact, the MedD is built on the consumption of olive oil, cereals, fruit and vegetables, a moderate amount of fish, dairy and meat, and many condiments and spices, occasionally accompanied by wine and coffee [11,12]. The MedD also promotes social interaction, it has given rise to a considerable body of cultural habits, it is deeply rooted in local territory, it protects biodiversity, and it ensures the conservation and development of traditional activities. In addition, the MedD is based on frugality (low caloric intake) that could contribute to sustainability of food systems.[5,7,13,14]

Impact of Diet on environment

The various food models have a different impact on the environment: the consumption of resources and

the emissions of greenhouse gases change according to the food consumed.

First of all, it should be emphasized that the agri-food system is one of the least efficient ones, as it consumes more energy than that produced. An indicator used to measure the unsustainability of the food sector is the Sustainability Index (SI), whose value is obtained from the ratio between energy required for the production of a food and the energy content of the food itself. From 1910 to 2010 the value of this index has increased: from the value of 1 typical of pre-industrial companies at the beginning of the last century it has reached almost 9 in the late seventies and a value greater than 100 in 2012. [13, 15,16]

The environmental impact of a wide variety of foods has been estimated by using three quantitative indexes: the carbon footprint, the ecological footprint, and the water footprint. [17]

The Carbon Footprint index measures the quantity of greenhouse gases released in the environment during the whole life cycle assessment of food. Following the Kyoto Protocol, Carbon Dioxide (CO2), Methane, Nitrous Oxide, Sulfur Hexafluoride, Hydrofluorocarbons, and Perfluorocarbons were included in the index. It has been demonstrated that these types of gases, not only increase global warming, but have also detrimental effect on the availability of nutrients like proteins, zinc, and iron in foods, the lack of which increase the risk of disease [13,14,17].

The Water Footprint index has been defined as the quantity of water used during the life cycle of a product. Most of the water used by food is not present in the final product, but is wasted during the supply chain or the production process. Farming is responsible for about 70% of overall water usage, while industries consume 22% of it, the remaining 8% is ascribable to domestic activities.

The Ecological Footprint index estimates the quantity of production area employed by an entity (i.e. individual, city) to generate the resources she consumes and to absorb the waste she creates. In detail, this index compares the productivity of ground (i.e. farming) against the efficiency of system in absorbing the pollution coming from production (i.e. forests) [13,14,17].

Meat and dairy products have the largest carbon, water, and ecological footprint. (figure 1) They are responsible for 14% of the total amount of greenhouse gasses produced by human activities since animal-related products require large quantities of animal feed [13,14]. For instance, seasonal vegetables produce 815 g/kg of CO2, while poultry meat produces 4000 grams of CO2 for the same quantity. The same goes for both water consumption and ecological footprint: vegetables and fruits need less than 1000 liters of

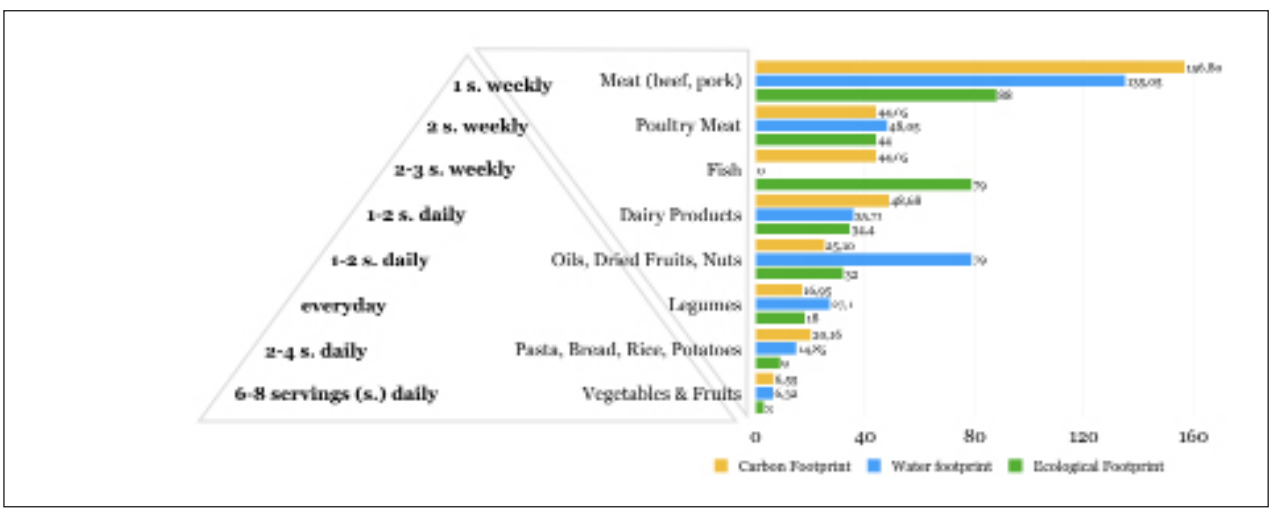

Figure 1. The double pyramid

water and about 3 m² per kg., whereas beef needs about 19.000 liters and 144 m² per kg [13,14,17].

Vegan and vegetarian diets have a reduced impact on the environment on each index, however, massive adoption of these diets is unlikely as this would mean a radical change in eating habits and traditions in places where animal-related products have a cultural role in the lives of individuals. [18] Vegetarian diets (meat-free dietary patterns) are also associated with reduced risks of several disease. Vegetarians have lower incidence of type 2 diabetes, obesity, coronary heart diseases, and other noncommunicable diseases [18].

Compared to the Western Diet, where consumption of meat, saturated fat, and sugar is high, the MedD has a reduced impact on the environment, is healthier, socially and culturally sustainable. [19]

A full adhesion by Italian population to the MedD in the period 2006-2011 would have saved about 152.000 million m² of water. On the contrary, if world population followed the Western consumption pattern, water needs would increase by 75% [3].

In addition, MedD fits with resilience economic project. The word, "resilience" derives from the latin word "resilire", which means jump back or, bounce back. In broad economic terms, resilience is the capacity of a person, a family, a community, a city or a region to prepare and put up with shocks and stresses, to adapt and quickly restart without compromising the long-term perspectives of development. [20] Understanding economic resilience means understanding how countries, regions, or cities recover from recessionary shocks, proving a better understanding of the complex spatial interdependencies and improving governance research. Throughout history Emilia-Romagna has proven to be a resilient region, able to adapt to severe environmental as well as economical shocks. Through cooperation Emilia-Romagna was transformed by its inhabitants from a swamp without prospects to a fertile land, to an industrial cluster of innovation, and to one of the places with the highest quality of life in Europe, where the massive presence of cooperative firms is a stabilizing factor in the regional economy. This italian region is adopting a Mediterranean diet in order to promote not only disease prevention but also a more advantageous and resilient economy system. [21]

Impact of Diet on health

The Med D pattern reached considerable importance in the scientific world, due to its effects in the prevention of cardiovascular diseases (CVDs). Following the first observation by Seven Country Study that adherence to Med D is inversely associated to CVD mortality, Med D acquired increasing importance in cardiovascular epidemiology. [22,23,24]

In 2001, the American Heart Association qualified the Mediterranean Food Pattern as potentially effective for the prevention of CHD, though emphasizing the need of more studies before suggesting people to pursue a MD pattern [25]

More recently, the 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease underlines that plant-based and Mediterranean diets, along with increased fruit, nut, vegetable, legume, and lean vegetable or animal protein (preferably fish) consumption, with the inherent soluble and insoluble vegetable fiber, have consistently been associated with lower risk of all-cause mortality than control or standard diets in observational studies. [2]

Similarly in the recently published 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD, "A Mediterranean diet, rich in polyunsaturated and monounsaturated fats, should be considered to reduce CV events" has a Class IIa indication. [26]

Dinu and coworkers performed an umbrella review estimating the association between the adherence to the Mediterranean diet and 37 different health outcomes including overall mortality, cardiovascular outcomes, cancer outcomes, cognitive disorders, metabolic disorders, as well as inflammatory parameters. The overall analysis comprised 13 meta-analyses of observational studies and 16 meta-analyses of RCTs, for a total population of over than 12 800 000 subjects. Considering the limitation of meta-analyses specifically related to the large heterogeneity of dietary assessment methods and inadequacies relating to the study design, Dinu and cowrkers concluded that the scientific literature has identified robust evidence of association between adherence to Med D and overall mortality, cardiovascular diseases, overall cancer incidence, neurodegenerative diseases and

diabetes. [27] Including Diet indication in Guidelines is a strong message for practical doctor, nurse, dietitian and for people working in medical ward. However we need to do more for transmitting the message to common people, mainly to young persons. To promote MedD, a sustainable and healthy Diet, it is crucial to understand which factors restrain changes in individuals' eating habits [1,4,28,29,30]. Healthy food is often perceived as more expensive. On contrary, some reports have shown that switching to a more sustainable diet may even be cheaper than most of the prevailing eating habits; reducing meat consumption extremely reduces household expenditures on food. [31,32,33,34] Insufficient knowledge about which foods are sustainable is also an issue. [35] In addition, while the composition of the Mediterranean diet and lifestyle is relatively standard—based on olive oil, grains, pulses fruits and vegetables, and little processed foods, there are necessarily country-specific variations in sustainable eating patterns incorporating these ingredients, according to local cultures and traditions.

The Rockefeller Foundation-Lancet Commission on Planetary Health suggested that dietary changes have the potential to improve both people and planetary health [36] Changing food choices to meet dietary requirements for health could also help toward mitigating climate change.

Food culture, which is informed by a certain country's or region's population, agricultural production, food processing and trade practices, purchase level, eating habits and cultural tradition, has a significant influence on food choice and is difficult to change. Surveys have shown that meats are a food with strong cultural resonance for many people [37] and this cultural resonance is a potential barrier to reduce meat consumption. Moreover, the correct lifestyle based an adequate diet, regular physical activity and weight management is both costly and time consuming and is a tough challenge. Interestingly, women rarely follow such a lifestyle, and this is strongly influenced by their income level, social role, education and culture. Modern women have multiple roles that are both time- and energy-consuming. In the developed countries, there is a trend towards uniformity in working patterns and activity between the sexes, although family responsibilities are often left to women. These joint obligations lead to an increase in psychosocial stressors (e.g. anxiety, depression and marital stress), which are known to further increase the overall cardiovascular risk. [29,38]

Conclusions

Young people care of environment as well as care of health and healthy diet. The Mediterranean Diet has shown to be a sustainable and healthy Diet and we need to improve knowledge about this Diet. The next target will be to adapt the Mediterranean Model to local food and traditions.

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