

## **CHAPTER 15. THE MEDITERRANEAN DIET**

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### **15.1 Origins of the Mediterranean Diet**

The Mediterranean diet has its origins in a piece of land considered unique in its type, the Mediterranean Basin, a place that historians call "the cradle of civilisation", because it was within its geographical boundaries where the complete history of the ancient world developed [1].

The Mediterranean Diet has been forged by the ancient civilizations of the Old World. In their passage through the Mediterranean Basin, they managed to transmit a part of their knowledge and customs, interweaving the foundations of this dietary model [3]. However, such a lifestyle could not have occurred without the invaluable role of the region's microclimate. The humidity, the many hours of sun in the hot and dry summers, the winters not too extreme, and the generous rains during spring and autumn turn this landscape into fertile lands where practically everything can be cultivated [4].

The first foods from which all this framework was constructed came from the Levant (specifically from Lebanon, Israel, Palestine, Syria, Jordan and Iraq), with the cultivation of cereals and legumes, and with the Phoenicians, Greeks and Romans, that introduced the cultivation of olive trees, wheat fields and vineyards. These last three cultivars are the founders of what is now known as the "Mediterranean trilogy", consisting of bread, oil and wine [3].

Two dietary patterns could be distinguished during the classical era:

- The classic-Mediterranean model, deeply rooted in Ancient Rome and originally from Greece, was based on agriculture. They had a large selection of fruits and vegetables, as well as nuts and cheese, leaving in the background the consumption of animal products (little meat was consumed in general, having a predilection for the intake of fresh fish and seafood).
- The barbarian-continental model. Germanic peoples (more inclined to livestock breeding) lived mainly from hunting, fishing and gathering of wild fruits; however, they also enjoyed small gardens where they could grow some vegetables and grains [5].

These two culinary cultures merged over the years until the agro-silvo-pastoral model was developed [6]. However, the Roman Empire never abandoned the great Mediterranean triad, which was gradually exported to the regions of Continental Europe by monastic orders.

Later, the fall of Western Europe into Arab-Muslim hands left an indelible mark on the new Romanesque-Germanic nutritional model. The diet in Al-Andalus was very rich and brought a new world of flavours with the introduction of sugar cane, citrus, eggplant, spinach, almonds, pomegranates and spices. On the other hand, they implemented a series of innovative agricultural techniques that marked a revolution in the world of farming. The exaltation of the diet as a fundamental pillar of health and human well-being is also attributable to them [7].

In addition, the Mediterranean Basin had the immense luck of having the most relevant routes and commercial enclaves, which allowed to import new and exotic food from the New World. With the discovery of America, there was a great exchange of foods, that included products such as potatoes, tomatoes, corn, peppers, chilli and different varieties of beans, coffee and chocolate [1]. Other regions that were relevant in this aspect were Asia and Oceania (exporters of rice, rosemary, pepper, sesame, ginger, basil, cucumber, etc.).

It is somewhat anecdotal that such an ancient tradition has not been encompassed within the term "Mediterranean Diet" until well into the twentieth century. During 1950s and 1960s there were numerous professionals who focused their interest in the nutritional study of Mediterranean lands.

The first scientific references to the Mediterranean Diet were made by the epidemiologist Leland G. Allbaugh in his report "Crete: A case study of an underdeveloped area". He tried to analyse all the factors that could exert some influence on the health of the Greeks, in order to establish future intervention plans. To accomplish this task, a specific population of the island of Crete was studied. It was concluded that the levels of consumption of the different nutrients were extremely balanced and that these eating patterns were very well adapted both to their natural and economic resources and to their needs [8].

The actual person responsible for the existence of the term "Mediterranean Diet" was American physiologist Ancel Keys, that would appear on the scene later on. He studied coronary heart disease and associated risk factors in his "Seven Countries Study" after World War II [9]. It was observed that the rural areas of southern Europe (corresponding to the Mediterranean Basin) and Japan had a lower incidence of heart disease, concluding that there should be something in the lifestyle of these lands which kept them away from these pathologies. This "something" was called "Mediterranean Way" or "Mediterranean Style", which would eventually be known as "Mediterranean Diet" after the dissemination of the study [10].

Professor Grande Covián, when describing the elements that make up the lunch of a farmer who works from sun to sun, praises the intelligence of the Mediterranean diet for selecting these products: "A "bota" sardine<sup>1</sup>, a piece of bacon, half a loaf of bread, some hanging tomatoes and a bit of wine". "Even NASA would not have found foods that took up so little space and were so specific to prevent the fainting and dehydration of a man on a manual harvest day". Glucose, salts, proteins and carbohydrates are wisely combined at lunch.

Trichopolou and collaborators were the first to define an index of adherence to the Mediterranean diet and thus compare the high or low adherence with the risk of mortality [11]. The Lyon Heart Study [12] concluded that the Mediterranean Diet, rich in  $\alpha$ -linolenic acid (ALA), was more efficient than other diets in preventing coronary processes. On the other hand, it has been observed that the incidence of cardiovascular diseases and cancer is much higher in Northern Europe than in Southern Europe, which has a direct relationship with the consumption of fruits and vegetables typical of the Mediterranean diet, that have a high content of compounds with antioxidant activity [13].

Additionally, it was observed that the Mediterranean diet was able to reduce total cholesterol, LDL, and triglycerides, increase HDL as well as enhance endothelial function and even showed an improvement in insulin resistance and a reduction in the metabolic syndrome [14]. On November 16, 2010, UNESCO included the Mediterranean Diet in the representative list of the Intangible Cultural Heritage of Humanity [15,16]. We are therefore faced with an ancestral cultural legacy that has evolved over millennia.

## 15.2 The concept of Mediterranean Diet

Many people think they know with precision what the Mediterranean Diet consists of, moreover, it seems logical to assume that what people in the Mediterranean regions usually consume should be part of it but, in fact, when it comes to defining such a diet only vague and intuitive notions come to us.

It would be a mistake to look for a brief and synthetic definition of what seems to be an ambiguous and extensive concept. The Mediterranean Diet is not simply a nutritional guideline, a way of combining food to decorate a table or satiate hunger, but it constitutes something infinitely

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1 A type of salted pressed sardine, traditionally kept in wooden barrels, very popular in Spain

more intricate, developed over the centuries by our ancestors, that reflects the constant transfer of civilisations through the Mediterranean Basin.

The Mediterranean Diet is a lifestyle that combines a healthy eating model (perfectly integrating native customs and traditions) with appropriate physical exercise habits.

The Mediterranean Diet Foundation describes the basic principles [12,17]:

- The use of olive oil as the main addition fat. It is rich in monounsaturated fatty acids (MUFAs) and in vitamins E and K (Chapters 4 and 6), being the most used fat in the Mediterranean region.
- Eating foods of plant origin in abundance: fruits, vegetables, legumes and nuts. Fruits and vegetables of different colours are recommended. In addition, it is advised that one of the vegetable rations must be eaten raw and the others can be cooked if desired. This way, we ensure an adequate supply of vitamins, among other components with antioxidant activity.
- Foods from cereals, such as pasta, rice and especially their whole grain products, like whole wheat bread, should be part of the daily diet. It is one of the main sources of energy for our body.
- The most adequate foods are minimally processed, fresh and seasonal. It is important to take advantage of seasonal products since, especially in the case of fruits and vegetables, it allows us to consume them at their best, both for nutrient supply and also for aroma and flavour.
- Eating dairy products, mainly yogurts and cheeses, daily. Consumption of fermented milks (yogurt, etc.) is associated with a series of health benefits because they contain live microorganisms capable of improving the balance of the intestinal microbiota.
- Red meat should be consumed in moderation, preferably lean meats, and as part of dishes based on vegetables and cereals. Processed meats only in small quantities and as snack ingredients. Consumption of three or four eggs a week is a good alternative to meat and fish.
- Eating fish. The consumption of oily fishes is recommended at least once or twice a week. Their fats are rich in omega-3 ( $\omega$ 3 or n-3) polyunsaturated fatty acids ( $\omega$ 3-PUFAs), that have cardioprotective effects. The recommendations of the World Health Organisation (WHO) issued in 2010 regarding the recommended consumption of omega-3 fats were: 0.250 grams/day for adults (EPA+DHA<sup>2</sup>), 0.3 grams/day for pregnant women (EPA+DHA). Maximum tolerable intakes: 2 grams/day.

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2 EPA: *all-cis-5,8,11,14,17-(E)icosapentanoic acid*. DHA: *all-cis-4,7,10,13,16,19-Docosahexaenoic acid*. See Chapter 4 (Section 4.2 and Table 4.2) for more information on fatty acids

- Fresh fruit should be the usual dessert. Fruits are very nutritious foods, being a good alternative as a snack. Sweets and cakes must be eaten occasionally, as they have no nutritional interest.
- Water is the quintessential drink in the Mediterranean, being essential in our diet. An intake of 1 to 1.5 litres/day is recommended. Wine should be taken in moderation and during meals. Wine is a traditional food in the Mediterranean diet that may have beneficial effects on health by consuming it in moderation and in the context of a balanced diet.
- Perform physical activity every day, as it is as important as eating properly. Staying physically active and performing a physical exercise adapted to our abilities on a daily basis is very important to maintain a good health.

Currently, all these postulates can be combined in what is known as the "Traditional Pyramid of the Mediterranean Diet" [17], that shows, in an illustrative and didactic way, which foods we should consume and in what proportion (Figure 12.2). Foods that are essential for the diet and must be consumed in abundance are located at the base of the pyramid, while products that must be eaten with moderation appear at higher (and narrower) levels. In addition, the composition and number of portions of the main meals are indicated [18].

### 15.3 Benefits of the Mediterranean Diet

The Mediterranean Diet provides us with many benefits against the most prevalent pathologies in our society. In recent years, some relevant studies have supplied numerous data that relate good health with nutritional patterns similar to those found in Southern Europe:

- **Reduction of cardiovascular disease risk.** High-fat diets, like those typical in North America, have been associated with the highest cholesterol levels and the highest mortality rates from acute myocardial infarction (AMI). This statement suggests certain inconsistency in the discourse of physiologists, since the Mediterranean diet has a daily fat intake of 30-35% (35% is acceptable as long as it is olive oil) of the total energy content. However, the factor that influences cardiovascular pathology is not the amount of fat consumed but rather the source it comes from, as well as its chemical composition (in the Mediterranean Diet intake would be predominantly of vegetable fat, rich in MUFAs, while that in the North American diet it would be of animal origin and with a noticeable percentage of saturated fatty acids -SFAs-). In relation to this, Ancel Keys along with Francisco Grande Covián and Joseph

T. Anderson studied the influence of the type of fatty acid (FA) consumed in the diet with cholesterol levels and formulated what is known as the equation of Keys, Grande and Anderson. This equation allows to estimate the variation in blood cholesterol levels from the percentage of saturated or polyunsaturated fat consumed in the diet [19]. Así mismo se ha observado que un extrato de tomate (rico en licopeno) con aceite de oliva virgen extra reduce los parámetros lipídicos y los biomarcadores de estrés oxidativo implicados en la patología cardiovascular [20].

The direct relationship between the excess of SFAs in the diet and the increase in cardiovascular risk has been supported by numerous studies [21,22,23], among them that of PREDIMED (Mediterranean Diet Prevention) [24]. It was concluded that both a diet supplemented with olive oil and a diet supplemented with nuts caused a reduction in cardiovascular risk. The study also highlighted a relative risk reduction of 30% among high-risk people who were free of disease at the start of the study. Another relevant fact that emerges from the trial is that the decrease in cardiovascular disease is more evident in cerebrovascular accidents. On the other hand, the consumption of oily fish at least once or twice a week is very healthy since these fishes have fats very similar to those of plant origin, which protect against heart disease. The Mediterranean diet is also rich in vegetables and fruits (it is advised to take 5 servings of fruit and vegetables daily), thus providing a high content of antioxidants and fibre, two factors that also prevent these diseases [25,26].

- **Attainment of healthy ageing.** Numerous studies suggest that the Mediterranean Diet could be associated with a lower risk of mild cognitive impairment during the ageing process, as well as during the transition stage between dementia and Alzheimer's disease [27,28]. PREDIMED elaborated another study [29] in which a better cognitive performance was seen in those individuals with high initial cardiovascular risk who consumed a greater amount of foods rich in polyphenols (due to their antioxidant potential) [30,31]. This contributes to reducing the risk of developing neurodegenerative diseases and cognitive impairment associated with age. When this type of diet was offered to a group of people, it was shown that they improved their memory and also verbal constructions. Foods that enhance memory and are part of the Mediterranean diet include nuts, which have  $\omega$ 3-PUFAs, and oily fishes that, additionally, contain many vitamins and minerals [32]. On the other hand, the Mediterranean diet reduces the likelihood of suffering from Parkinson's disease [33].

Olive oil was related to a better verbal memory, nuts with a better working memory and wine with better results in the Mini-Mental test. It has also been observed that the polyphenols present in red wine could have a neuroprotective effect on Alzheimer's disease and Parkinson's [34]. According to the latest scientific evidence, extra virgin olive oil improves brain connectivity and reduces the permeability of the blood-brain barrier, which suggests that it is the EVOO polyphenols that contribute to this effect [35].

The PREDIMED study confirms that a Mediterranean-style diet can be a useful tool in the management of metabolic syndrome characterised by high cholesterol levels, abdominal obesity, hypertension and hyperglycemia.

- **Nutritional habits and cancer.** It has been previously mentioned that there may exist a relationship between nutritional habits and cancer [36,37]. Thus, it has been observed that the polyphenols contributed by olive oil could protect us from damage and cellular stress associated with breast cancer, due to their antioxidant capacity [37]. Good adherence to the Mediterranean Diet has also been shown to have a protective role against certain digestive neoplasms, especially against colorectal cancer [38].
- **Obesity reduction.** The Mediterranean diet can reduce of the risk of overweight among children, a problem that is increasingly growing. A recent study performed by professionals of the Catalan Institute of Health (ICS) has shown that the promotion of the Mediterranean diet in children between 8 and 10 years old reduces the prevalence of overweight by 6.3 points [39]. Moreover, the recommendations to reduce the intake of unhealthy foods, such as many industrial foods, were successful and reduced the consumption of these foods by half among the children who took part in the study.
- **Prevention of diabetes.** The Mediterranean diet is rich in fruits, vegetables and seasonal products, which makes it good for reducing diabetes. This is due to the low-fat diet that involves, along with whole grains, fish and the use of olive oil and herbs instead of butter and salt for cooking and to accompany various ingredients [40].
- **Reduction of bone fracture risk.** In the XIV National Congress of the Spanish Association for the Study of Menopause (AEEM) it was concluded that a greater adherence to the

Mediterranean diet is related to a lower risk of hip fractures, due to the large calcium intake of this diet, among other reasons [41,42].

Other pathologies in which the Mediterranean diet has been shown to have positive effects, can be pointed out, thus, it improves the proper functioning of the kidney and heart, reduces the consumption of preservatives and additives, etc.

In summary, adherence to the Mediterranean diet:

- Increases blood levels of high density lipoproteins (HDL), which are beneficial for health.
- Decreases blood levels of total cholesterol and LDL.
- Increases the body's antioxidant capacity.
- Raises levels of vitamin C, E, beta-carotene and polyphenols in the blood.
- Lowers blood pressure levels because it has a low sodium content and is abundant in potassium and fibre.
- Helps to detoxify substances in the liver.
- Reduces the risk of thrombosis, acting on the mechanisms of coagulation.
- Protects the arteries, dilating them and stimulating the production of the enzyme nitric oxide synthase of the endothelium (inner layer of the arteries).
- Decreases inflammatory reactions.
- Modifies the expression of genes and increases the immune capacity of defence.

#### **15.4 Adherence to the Mediterranean Diet**

Despite the growing evidence on its benefits for DM, recent data indicate that adherence to this eating pattern is declining in Mediterranean regions, particularly among children and adolescents.

Cabrera et al. evaluated adherence to DM in a population of 24,067 children and adolescents using the KIDMED test; the results showed high adherence to DM in 10% of the population, while low adherence accounted for 21%, so there was a clear trend towards abandoning the Mediterranean lifestyle [43]. Globalization and the adoption of Western dietary patterns partly explain the low rate of adherence in adolescents residing in the Mediterranean region. García-Meseguer's group tried to characterize the eating habits of Spanish university students and assess the quality of their diet. 27.5% of the students showed a BMI above normal values and 75% claimed to have a sedentary life. The evaluation of the quality of the diet carried out by the healthy eating index received a low score, so that only 5.3% of the students had a high adherence to the MD. [44]. In 2022, Obeid et al., carried



out a data collection on adherence to MD, mainly carried out in the European Mediterranean basin, and adherence is still very moderate [45].

## 15.5 Current Mediterranean Diet

Mediterranean diet foods are, as the name suggests, those foods that are grown, hunted, or caught in all regions around the Mediterranean Sea. The traditional Mediterranean Diet, up to 1950s, would be a "natural diet" characterised by the consumption of local and seasonal products, of a rather high variety, and traditional techniques of cooking, preservation, and presentation.

While it is true that the Mediterranean Diet is a nutritional pattern built over centuries, so is the fact that societies are constantly changing and developing. In an increasingly industrialised population, where fast food chains and foods with considerable amounts of additives are abundant, it is difficult to find healthy nutritional habits [46,47]. Meals have stopped being an important moment of the day, now they are a small break from the constant stress in which we live. People have stopped having time to cook and the easy option offered by supermarkets directly threatens the lifestyle proposed by the Mediterranean Diet.

The recommended nutritional goals for good nutritional habits (Table 15.1) have been replaced by a greater contribution of fat (from 30 to 40-42% of the recommended total energy intake), the increase being mainly in saturated fat. Proteins have also suffered a considerable increase, from 0.8 g of protein per kg of body weight we have moved to 2 g and even higher levels. This has decreased carbohydrates consumption from 55-60% to the current 40-45%, the majority of them being simple sugars, from pastries and soft drinks, that are associated with a series of pathologies, such as obesity, diabetes, high cholesterol levels, hypertension, etc., the so-called metabolic syndrome [48,49,50,51].

The abandonment of these habits is evident when observing the general population. Obesity is the new epidemic of the 21st century and is promoted by highly manipulated products that we consume regularly without being aware of it. Moreover, metabolic diseases (diabetes, dyslipidaemia, etc.) and cancer are the order of the day among the adult population [52]. An exercise in reflection and awareness about all this is important, otherwise, society will be destined to live with greater co-morbidities and to experience a rather unsatisfactory old age [53,54,55,56, 57].

## **LEGEND TO TABLE**

**Table 15.1. Population nutrient intake goals for the prevention of diet-related chronic diseases.**

## **LEGENDS TO FIGURES**

**Figure 15.1. Potential distribution of the olive tree over the Mediterranean Basin.** Source: [2]

**Figure 15.2. The Mediterranean diet pyramid.** Source: The Mediterranean Diet Foundation, Barcelona, Spain, <https://dietamediterranea.com/en/nutrition/>

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