1 Overview

Summary

- Olive oil is the main dietary fat in the Mediterranean diet (MedDiet), and there is high consumption of fruits, vegetables, unrefined cereals and legumes, moderate consumption of fish, dairy products and wine, and low consumption of meat.
- There are many variations of the MedDiet reflecting influences of culture and landscape.
- Factors such as social eating and physical activity are also important, so the MedDiet represents a whole lifestyle.
- There is strong epidemiological evidence for a protective effect by the MedDiet against cardiovascular diseases and also protection against cancers and neurological disorders. Many biologically plausible mechanisms have been developed to explain these health benefits.
- There is increasing evidence that the health benefits are best explained by considering the overall dietary pattern.
- Consumption of the MedDiet is decreasing in some Mediterranean countries, whereas consumption of Mediterranean foods in some North European countries is increasing.

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1.1 Development of the MedDiet

The Mediterranean diet (MedDiet) is tasty, easy to prepare and extremely healthy. The ability of the MedDiet to help prevent a wide range of today's most common ailments has been confirmed in numerous studies, and more widespread implementation of a MedDiet would undoubtedly result in significant public health benefits. How has this cuisine become one of the healthiest in the world? Probably part of the answer lies in the enlightened understanding in the Mediterranean of the link between food and health. From the Ancient Greeks to the Moors onwards, the MedDiet has been developed not only for its gastronomic virtues, but also as a synonym for a complete system of life. Another important aspect of the MedDiet is related to climate. The long growing season in the Mediterranean reduces the need for complex preservation techniques, and this has permitted an emphasis on natural, seasonal ingredients. The reliance on fresh ingredients cooked from raw is probably the single most important factor in Mediterranean cuisine that helps to ensure the consumption of a balanced intake of nutrients. Many traditional cooking pots, such as the *tagine*, *paella* and *plancha*, are still widely used in Mediterranean countries

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and have given their names to classic Mediterranean dishes. Although originally developed to enhance flavour, these vessels are employed in cooking techniques that help enhance the health benefits of the food. Indeed, flavour and health are closely interlinked in any cuisine based on natural ingredients. A third factor is the dominance of the olive and the eschewing of animal products rich in saturated fat. Cooking vegetables with olive oil is the quintessential Mediterranean way of obtaining the benefits of both taste and health. Hence, the MedDiet represents a legacy of the link between Man and the Mediterranean environment that has existed since the time of the last Ice Age.

1.1.1 A brief history of the MedDiet

The land surrounding the Mediterranean sea has been the cradle for many civilisations and cultures, and the MedDiet represents one of the most significant achievements of these civilisations. Agriculture itself began with the cultivation of cereals and pulses in the Levant, a region which comprises the Eastern Mediterranean countries of Lebanon, Israel, Palestine, Syria, Jordan and Iraq. Later, the Phoenicians, Greeks and Romans cultivated the three basic elements of the MedDiet: olive trees for producing olives and olive oil, wheat for making bread, and grapes for fermenting into wine. These colonisers of the Mediterranean basin then spread olives and grapes to the Western Mediterranean. A wide range of vegetables were already being consumed by the time of the Romans including onions, leeks, lettuce, carrots, asparagus, turnips, cabbage, celery and artichokes. Among the fruits consumed by this time were figs, apples, pears, cherries, plums, peaches, apricots and citrons (a type of citrus fruit). Chestnuts, almonds and walnuts were also eaten [1, 2].

Important developments in the MedDiet occurred from the 8th century when the Moors occupied much of the Iberian peninsula (calling the region al-Andalus). The Moors introduced rice, lemons, aubergines (American: egg plants), saffron and other spices, and these products then spread, to varying extents, throughout the Mediterranean basin. The Moors had a particularly enlightened awareness of the importance of diet for general health. For them, 'diet was a synonym for a system of life. It included the practice of eating correctly, of choosing the best places for staying healthy and lengthening one's life, of bathing and washing correctly, of sleeping and staying awake, of expelling useless substances from one's body and of dealing with the ups and downs of the spirit' [3]. The occupation by the Moors ended in 1492, and this was the same year that Christopher Columbus arrived in the New World. Columbus returned to Spain with tomatoes and bell peppers, and these are now an integral part of the MedDiet.

1.1.2 The traditional MedDiet and present day MedDiets

The term 'Mediterranean diet' was originally coined in the 1950s by Ancel Keys, the epidemiologist who first recognised the health benefits of this way of eating. Since then, the MedDiet has undergone many changes, and it is now convention to use the term 'traditional' MedDiet to indicate the type of diet that could be found in rural communities in the 1950s and early 1960s, especially in Southern Italy and Greece (and rural Crete in particular), and before the impacts of migrations to the towns, rising wealth and modern food technologies. The traditional MedDiet was shaped by terrain and climate. Cereals and vegetables were grown in the flatter,

low-lying areas, vines and olive trees on the slopes, and higher ground was left for grazing sheep and goats. The Cretan diet up until the 1960s has been described as 'olives, cereals, grains, pulses, wild greens, herbs and fruits, together with limited quantities of goat meat and milk and fish … no meal was complete without bread … olives and olive oil contributed heavily to the energy intake … food seemed to be "swimming' in oil"' [4].

There are various formulations of what is meant by the term 'traditional MedDiet', and the following list is taken from a statement issued by a working group at the MedDiet 2004 International Conference [5]:

- Olive oil as added lipid
- Daily consumption of vegetables
- Daily consumption of fruits
- Daily consumption of unrefined cereals
- Bi-weekly consumption of legumes
- Nuts and olives as snacks (generally eaten just before a meal)
- Bi-weekly consumption of fish
- Daily consumption of cheese or yogurt
- Monthly or weekly consumption of meat or meat products
- Daily moderate consumption of wine, if it is accepted by religion and social grounds

Although this list sums up most of the important aspects of a traditional MedDiet, other versions include consumption of herbs and spices, herbal teas, and wild greens gathered from the countryside, and also the importance of significant levels of physical activity.

The traditional MedDiet is a rich source of macronutrients and micronutrients. It is not possible to define the precise amounts of various beneficial nutrients in the MedDiet because of significant variations between countries (see below). However, one set of figures, based on an analysis of a traditional Greek diet, is shown in Table 1.1.

Fats are an important component of the traditional MedDiet, and account for about 30% of total calories in Spain, and up to about 40% of total calories in Greece [7] This compares with about 34% in the American diet [8]. Hence, the traditional MedDiet is not a low fat diet. There are, however, significant differences in the fatty acid composition compared to a North European or a North American diet. This is mainly due to the fairly low level of saturated fats in the MedDiet (7–8% of total calories), and relatively high consumption of monounsaturated fatty acids (MUFAs) (>20% of total calories), which is mostly oleic acid derived from olive oil. Not only are total saturated fats relatively low in a traditional MedDiet, but the types of saturated fatty acids (SFAs) consumed are quantitatively different to those in a North European diet. This is partly because consumption of SFAs from meat and cow's milk is relatively low, and consumption of SFAs from cheese and yogurt made from goat and sheep milk can be quite high. Goat and sheep milk contain a relatively high percentage of medium chain fatty acids (MCFAs) compared to cow's milk, and these are not as strongly associated with adverse effects on plasma cholesterol levels as some longer chain SFAs. The Greeks have one of the highest consumption of cheese in the world – at 26 kg per person per year (2005 figures) it is even higher than for the French! But about half of this is feta, a cheese traditionally made with ewe's milk and up to 30% goat milk.

Table 1.1 Estimated daily intake of macro- and micronutrients in a Greek MedDiet [6]. Reproduced with permission. © 2006 Elsevier.

Component	Daily intake
Macronutrients	
Protein	74.5 g
Carbohydrates	255.8 g
Dietary fibre	29.8 g
Ethanol	14 g
Total lipids	110.7 g
SFA	29.8 g
MUFA	63.8 g
PUFA	9.9 g
TFA	1.4 g
Phytochemicals	
Flavonoids	118.6 mg
Carotenoids	65.7 mg
Sterols	256.8 mg
α-tocopherol	4.3 mg
Inorganic constituents	
K	1774 mg
Fe	14.9 mg
Na	2632 mg
Ca	696 mg
Mg	234 mg
Zn	10.3 mg
Cu	3.8 mg
Mn	3.5 mg
Total energy value	2473 Kcal

SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; TFA, trans fatty acids.
Note: There were no data on vitamins in this analysis.

The traditional MedDiet is also a good source of polyunsaturated fats (PUFAs). Fish is the main contributor of the long chain (LC) *n*-3 FAs eicosapentaenoic acid (EPA) (20:5 *n*-3) and docosahexaenoic acid (DHA) (22:6 *n*-3). There is a modest intake of the *n*-6 fatty acid linoleic acid from nuts and sunflower seeds and pumpkin seeds, and these are popular aperitif foods in some Mediterranean countries. Linoleic acid is the predominant fatty acid in many seeds such as sunflower seeds and corn, and hence in oils made from these seeds. Seed oils are not a significant part of the traditional MedDiet and, as a consequence, *n*-6 fatty acid consumption is lower than in North Europe and North America. However, it should be mentioned that corn oil and sunflower oil are now increasingly replacing olive oil for cooking in some Mediterranean countries due to their lower cost.

Fats in the MedDiet

- High consumption of MUFAs, particularly oleic acid from olive oil
- High consumption of LC *n*-3 PUFAs (α-linolenic acid – ALA, EPA and DHA)
- Relatively low consumption of *n*-6 PUFAs
- Relatively high consumption of SCFAs and MCFAs from goat and sheep milk

Table 1.2 Estimate of the macronutrient composition of a typical MedDiet and a typical western diet (data from [9]).

Macronutrients	Mediterranean diet (%)	Western diet (%)
Carbohydrates	47	42
Proteins	15	20
Saturated fats	10	17
Monounsaturated fats	22	14
Polyunsaturated fats	6	7

Besides its typical fat composition, the MedDiet is also a rich source of a variety of carbohydrates, and these are discussed in Chapter 2. One estimate of how the overall proportions of macronutrients in a 'typical' western diet compare with those in a 'typical' MedDiet is shown in Table 1.2 [9]. This estimates MUFA intake in the MedDiet at 22% compared to 14% in a typical 'Western' diet. Although this analysis estimates that total PUFA intake between the two diets is similar, it should be noted that this analysis did not distinguish between *n*-6 and *n*-3 PUFAs.

Due to the high consumption of plants foods, the traditional MedDiet is a particularly rich source of plant chemicals (phytochemicals) and some vitamins and minerals (see Table 1.1). One aspect of particular relevance here is that plasma folate levels have been found to be a good biomarker for adherence to the MedDiet [10]. This mainly reflects the high consumption of green leafy vegetables in the MedDiet. Folate consumption is linked to a wide range of beneficial effects in the body, including prevention of neural tube defects in early pregnancy, and protection against cancers of the pancreas, oesophagus and colon-rectum [11]. By contrast, folic acid given in supplements has been shown to promote the progression of pre-malignant colorectal lesions [12]. This illustrates the increasing evidence that micronutrient supplements may not always afford the same protective effects attributed to dietary sources. This is an important point in the debate between whole diets and the use of supplements, and is discussed further in later chapters.

Although a traditional MedDiet is still widely consumed, especially by more elderly people, the diet is now increasingly under threat. Protecting healthy traditional diets against the encroaching uniformity of food, particularly the influence of fast food, is now recognised as a high priority [6]. Consequently, there was an initiative by Spain, Italy, Greece and Morocco to help protect the traditional MedDiet by applying for it to be adopted by UNESCO's Intergovernmental Committee for the Safeguarding of the Intangible Cultural Heritage of Humanity [13]. The MedDiet achieved this recognition in November 2010. The box below gives the statement issued by UNESCO at the time of this recognition, and emphasises how much the MedDiet represents an overall lifestyle rather than just the consumption of food.

UNESCO DECLARATION ON THE MEDITERRANEAN DIET AS AN INTANGIBLE CULTURAL HERITAGE OF HUMANITY

http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011&RL=00394

The Mediterranean diet constitutes a set of skills, knowledge, practices and traditions ranging from the landscape to the table, including the crops, harvesting, fishing, conservation, processing, preparation and, particularly, consumption

of food. The Mediterranean diet is characterized by a nutritional model that has remained constant over time and space, consisting mainly of olive oil, cereals, fresh or dried fruit and vegetables, a moderate amount of fish, dairy and meat, and many condiments and spices, all accompanied by wine or infusions, always respecting beliefs of each community. However, the Mediterranean diet (from the Greek diaita, or way of life) encompasses more than just food. It promotes social interaction, since communal meals are the cornerstone of social customs and festive events. It has given rise to a considerable body of knowledge, songs, maxims, tales and legends. The system is rooted in respect for the territory and biodiversity, and ensures the conservation and development of traditional activities and crafts linked to fishing and farming in the Mediterranean communities which Soria in Spain, Koroni in Greece, Cilento in Italy and Chefchaouen in Morocco are examples. Women play a particularly vital role in the transmission of expertise, as well as knowledge of rituals, traditional gestures and celebrations, and the safeguarding of techniques.

The current widespread interest in the MedDiet has necessitated the development of various definitions of what constitutes a 'modern' MedDiet. Such a definition is particularly important for epidemiologists in order to be able to assess the adherence of individuals to a MedDiet [14]. Many of these epidemiological studies have been conducted in European Mediterranean countries, and hence the definitions of the MedDiet tend to reflect the traditional MedDiet of these countries [10]. One widely-used definition of the relative consumption of nine key food groups is as follows:

1. high consumption of olive oil and low consumption of lipids of animal origin (resulting in a high ratio of monounsaturated to saturated fat)
2. high consumption of vegetables
3. high consumption of fruit
4. high consumption of legumes
5. high consumption of cereals (including bread)
6. moderate to high consumption of fish
7. low to moderate consumption of milk and dairy products (mainly cheese and yogurt from goats and sheep milk)
8. low consumption of meat and meat products
9. moderate consumption of wine

The use of current definitions of the MedDiet is discussed in Chapter 8, and the application of these assessments to disease prevention is considered in Chapters 10–13.

It is important to recognise that the MedDiet not only defines foods whose consumption *is* desirable, but should also encompass foods whose consumption is *not* desirable. This includes the absence of industrial processed foods, and is one reason for the relatively low levels of salt, saturated fat, trans fats and sugar in the MedDiet compared to the standard Western diet.

1.1.3 International differences

Despite some similarities between MedDiets, it is generally agreed that there is no one MedDiet. This is not surprising in view of the fact that Mediterranean countries are located in three different continents, namely Europe, Asia and Africa. These continents

have major cultural differences, not least of which is religion: European Mediterranean countries are Christian and those in Asia and Africa are Muslim. Hence wine consumption, a cornerstone of the European MedDiet, is absent in Muslim countries where alcohol consumption is prohibited. There are many other differences throughout the Mediterranean basin that can influence dietary habits, and these range from climate and geography, to socio-economic factors, culture and history. These can be regional as well as international. For example, consumption of fish within a country tends to vary depending on proximity to the sea, and, at the international level, low consumption in some countries is also due to the relative scarcity of fish in some parts of the Mediterranean. Even olive oil consumption – considered another cornerstone of the MedDiet – can vary widely between Mediterranean countries. Hence, the overall types of foods can vary quite widely between various Mediterranean regions as is illustrated in Table 1.3.

The geographical boundaries within which a 'MedDiet' is eaten are not precisely defined. Twenty-one countries border the Mediterranean sea (although this number varies according to the definition of a national state) (Figure 1.1). The climates of these countries can vary widely from region to region, and parts of many countries that border the Mediterranean sea do not have a 'Mediterranean' climate in its precise climatological definition. (This is defined by climatologists as the Cs climactic region, i.e. having warm to hot, dry summers and cool, wet winters.) Even bordering the Mediterranean sea itself does not guarantee a MedDiet since parts of the coasts of Libya and Egypt do not have a Mediterranean climate. Northern Italy is another region that does not have a Mediterranean climate and correspondingly the traditional diet here is quite different to that found in Mediterranean Southern Italy. In France, only the regions of Provence, Languedoc and part of Roussillon have a Mediterranean climate, and the cuisines of other regions are quite different. By contrast, many parts of Portugal do have a Mediterranean climate, although this country is on the Atlantic seaboard and has no border with the Mediterranean sea.

A poetic, yet very useful, definition of the Mediterranean is that of the French writer Georges Duhamel who wrote: 'The Mediterranean ends where the olive tree no longer grows'. This can be used to delineate the northern limits of 'Mediterranean' cuisine and is shown in Figure 1.2.

The Mediterranean climate, as defined by climatologists, is not restricted to countries of the Mediterranean region but includes parts of California, the Western Cape in South Africa, central Chile, southern Western Australia and the coastal areas of central and south-east Australia (Figure 1.3). For cultural and historical reasons, these countries did not develop a traditional MedDiet. However, their climates have allowed the production of traditional Mediterranean foods, especially grapes, and, increasingly, olives, and levels of production of traditional Mediterranean foods are increasing in these countries.

1.1.4 National representations of the MedDiet

Efforts to promote the MedDiet have led to the development of various pictorial representations. These graphics aim to convey the essentials of the MedDiet in a single glance without recourse to lengthy text, as it is considered that this could be off-putting to some people. The design of the graphic is often angled in order to appeal to the populace of a particular country.

Perhaps the best known of these pictorial representations is the food pyramid developed by the American organisation Oldways (Figure 1.4). This structure is

Table 1.3 Important food groups in Mediterranean regions (from [15]). With permission from Elsevier.

Mediterranean region	Cereals	Dairy	Olive oil consumption	Meat	Other
Western (Spain, France, Italy, Malta)	Bread, rice, pasta	Cheeses	High in Italy and Spain	Pork	Potato
Adriatic (Croatia, Bosnia, Albania)	White wheat flour as bread and pitta	High (butter, buttermilk, ricotta, cheese, sour cream)	Low to moderate	Beef	
Eastern (Greece, Lebanon, Cyprus, Turkey, Egypt)	White flour products	Various cheeses	Very high in Greece, negligible in Egypt	Chicken*	Okra in summer, herbs (dill, parsley, oregano)
North Africa (Libya, Algeria, Morocco, Tunisia)	Bread made from whole meal flour and barley flour Couscous		Wide range	Lamb	Potato, pumpkin, chickpeas, dates, date molasses

*Lamb is also popular, especially in Greece.



Figure 1.1 Countries of the Mediterranean Basin (Wikipedia). The countries bordering the Mediterranean sea are (with semi-autonomous countries): Gibraltar, Spain, France, Monaco, Italy, Slovenia, Croatia, Bosnia & Herzegovina, Albania, Greece, Turkey, Cyprus, Syria, Israel, Lebanon, Egypt, Libya, Malta, Tunisia, Algeria, Morocco.

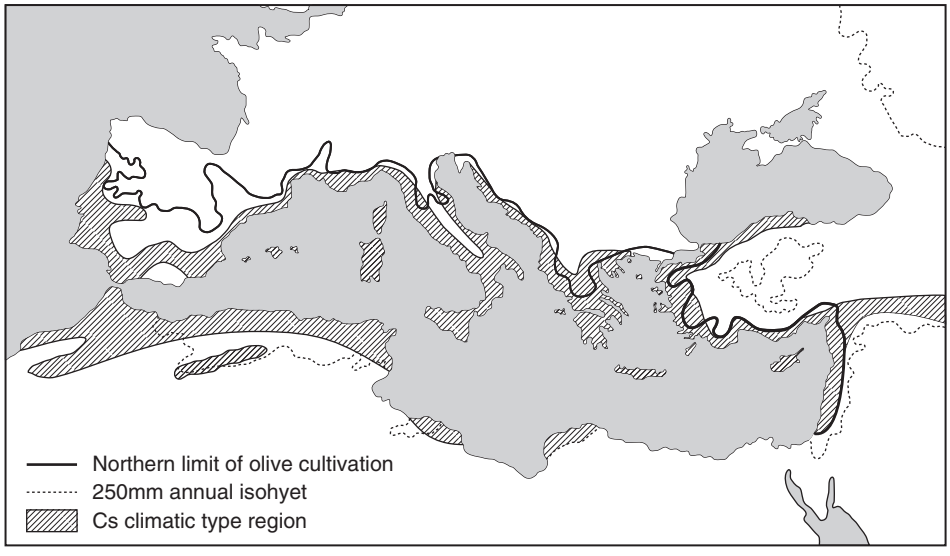


Figure 1.2 The Mediterranean region as defined by the northern limits of olive cultivation (black line) and climate (hashed areas) [1]. With permission from John Wiley & Sons.

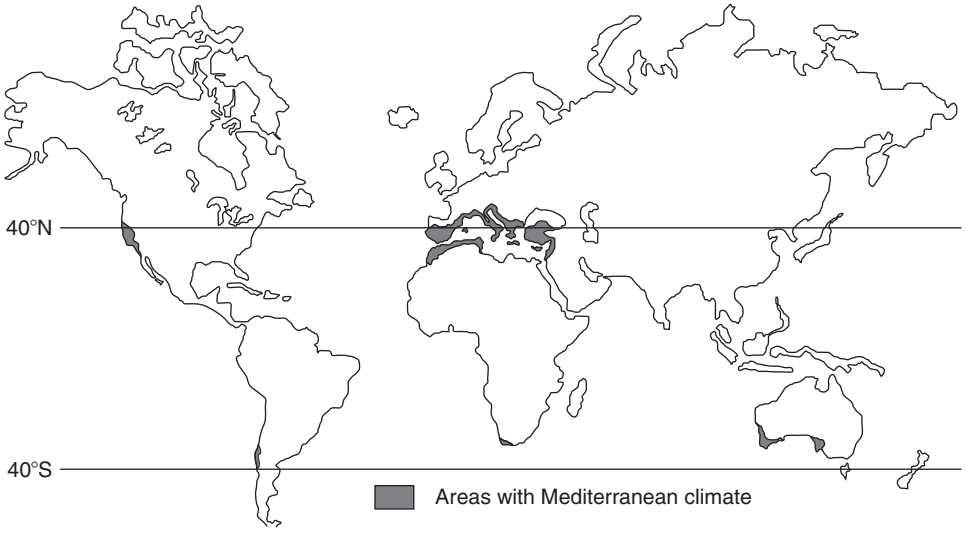


Figure 1.3 Regions of the world with a Mediterranean climate (Wikipedia).

similar to the US Food Guide Pyramid developed by the USDA. The Oldways pyramid has been refined over several versions. The base of the pyramid depicts physical activity and enjoying food with others. The remainder of the pyramid depicts the relative proportions of various foodstuffs that should be consumed, with the largest portion of the pyramid being devoted to plant foods. In addition, this 2009 version includes herbs and spices for the first time, although wild greens are not included, perhaps because their collection is not a traditional part of food culture in industrialised countries such as the US. Fish and shellfish have a prominent

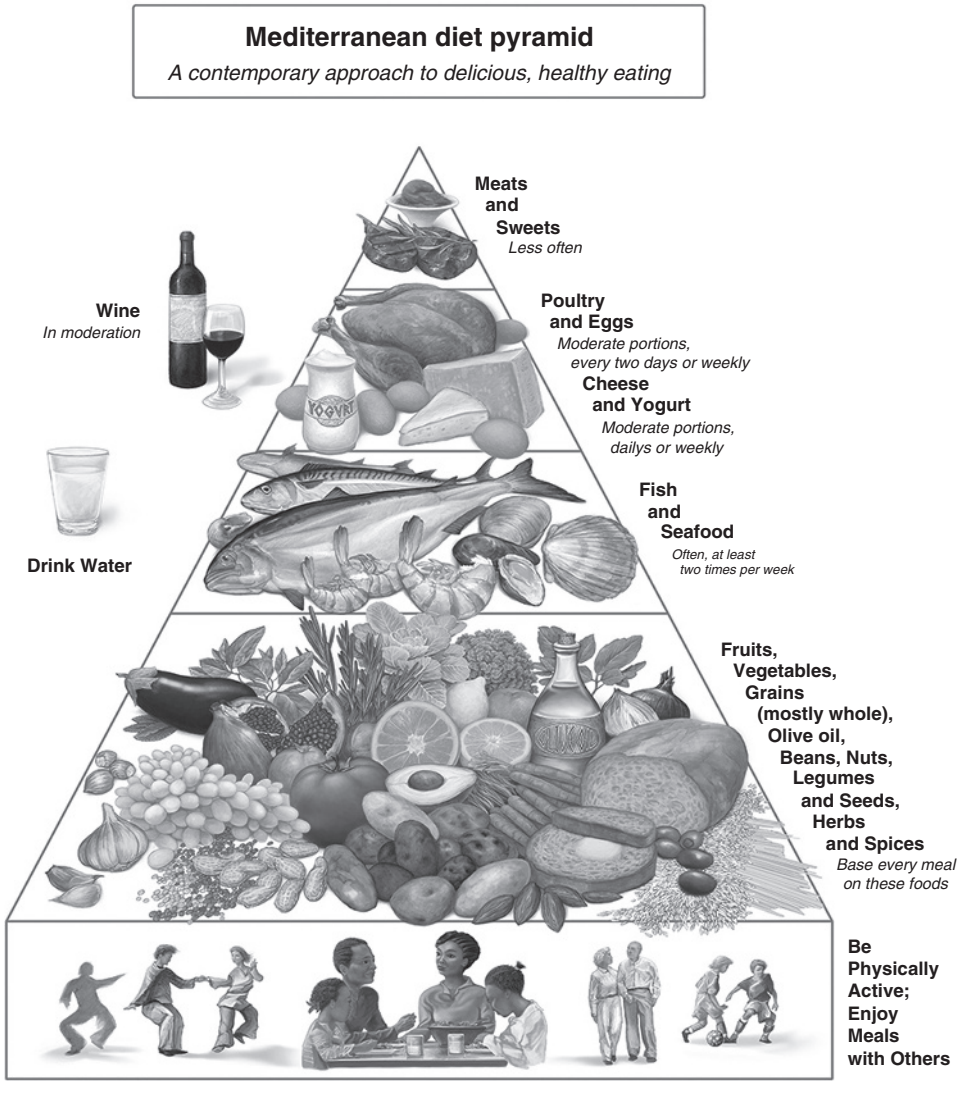


Figure 1.4 The Oldways' pyramid depiction of a MedDiet [16]. Reproduced with permission. © 2009 Oldways Preservation & Exchange Trust, www.oldwayspt.org

position, with lesser amounts of poultry and dairy produce. No distinction is made between dairy produce from cow milk (uncommon in the traditional MedDiet) and milk from goats and sheep, although cheese and yogurt are depicted and milk is excluded, and this is consistent with a traditional MedDiet. Meats and sweets are simply advised to be eaten 'less often'. Wine in moderation and water are also shown.

Nutritionists in Mediterranean countries may not necessarily consider (Egyptian) pyramids to be the most appealing depiction of the MedDiet for their populaces, so they have developed images more representative of their own countries. Greek nutritionists have come up with the idea of seven Greek columns, each column showing the food to be consumed – in words rather than images – on one day of the

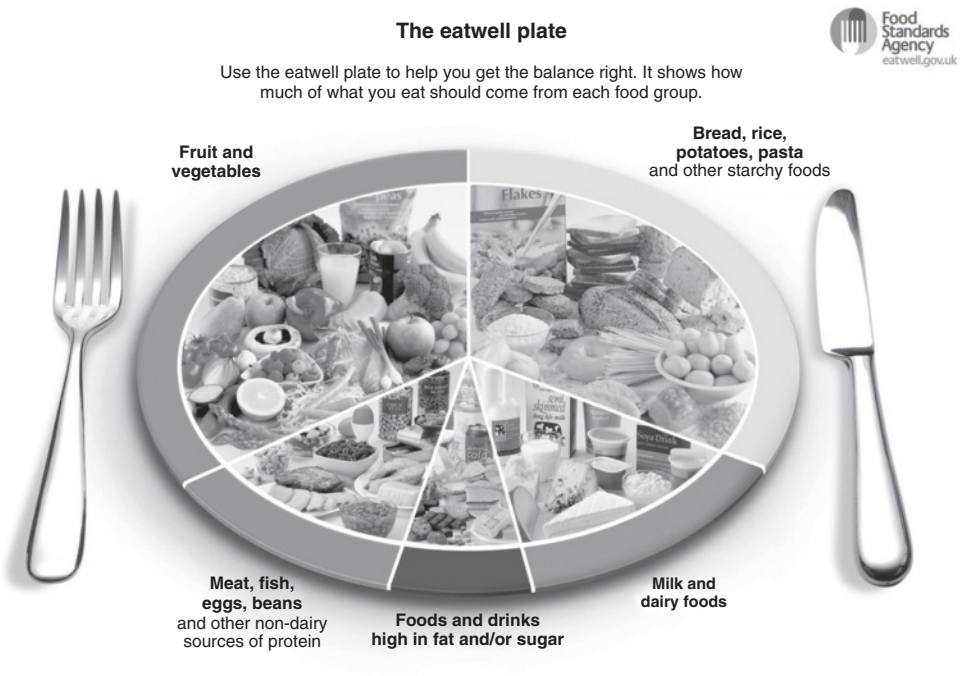


Figure 1.5 The Food Standards Agency Eatwell plate (http://www.eatwell.gov.uk/healthydiet/eatwellplate/). © Crown copyright material 2007, with permission from the Controller of HMSO and Queen's Printer for Scotland.

week [17]. The basic principles of a healthy way of life, 'moderation, variety and proportionality', are also mentioned, together with having a correct energy balance. Italian nutritionists have developed the historical theme by turning the Greek column into a Greco-Roman temple, an apparent attempt to capitalise on the idea that a temple symbolises 'healthiness, spirituality and self-improvement' [18]. In this Italian model, the steps of the temple convey a healthy lifestyle, the need for adequate exercise, and to use virgin olive oil and to drink wine in moderation. The columns of the temple represent desirable food groups, and foods that should only be consumed in limited amounts are shown at the top of the temple. A practical weekly guide has also been developed for French consumers [19] and this is discussed fully in Chapter 14.

It is interesting to compare these representations of the MedDiet with a current pictorial representation of UK dietary guidelines as promoted by the UK Food Standards Agency (FSA) – the so-called 'Eatwell Plate' (Figure 1.5). Although there are some similarities, there are also significant differences. Fruits, vegetables and carbohydrates all feature prominently on the Eatwell Plate, and this is similar to the representations of the MedDiet. Dairy products (from cow milk) are a more prominent feature on the Eatwell Plate than on the MedDiet depictions, reflecting a long tradition of dairy farming and dairy consumption in the UK. No distinction is made on the Eatwell Plate between the relative proportions of meat and fish to be consumed. Cakes and biscuits represent a relatively large slice of the Eatwell plate. Although these are also depicted on some of the MedDiet graphics, in the MedDiet these products are likely to be based on fruit, honey, nuts and olive oil, whereas in

the UK there will be a far higher content of refined sugar and saturated fat. Olive oil and wine are absent from the Eatwell Plate.

1.1.5 Sources of information for the general public

Mediterranean restaurants and cookery books

Tourism has had a major impact on the appreciation by North Europeans of Mediterranean cuisine, not to mention Mediterranean wines. There are now a plethora of Mediterranean restaurants in most towns. Elizabeth David pioneered home cooking of Mediterranean food in the UK with the publication of her book *A Book of Mediterranean Food* in 1950. It remains in print to this day. Many other Mediterranean cookery books are now available and some, such as those by Claudia Roden on Middle Eastern cookery and those by Clifford A. Wright, are scholarly works and include authentic recipes. There is, however, very little information on whether or not cookery books promote a healthier lifestyle. In the case of Mediterranean cookery books, most do not give a clear indication of the relative proportions of different foods that should be eaten – a fundamental aspect of healthy eating. Some books emphasise recipes using ingredients readily available to the non-Mediterranean cook rather than being truly representative of local Mediterranean cooking. In particular, MedDiet cookery books often include a relatively high proportion of recipes that contain meat, and this is not representative of a traditional MedDiet.

MedDiet organisations

There are several organisations that promote the MedDiet, and these have useful websites. The Mediterranean Diet Foundation (La Fundación Dieta Mediterránea, FDM) is a non-profit organisation based in Barcelona, Spain which promotes the investigation and dissemination of the MedDiet and the Mediterranean lifestyle. It organises conferences, runs courses, and organises a range of workshops with a particular focus on children and the elderly. Its website is at http://www.fdmed.org. Oldways is an American non-profit organisation that was responsible for developing the best-known of the Mediterranean diet food pyramids (see above). It promotes the MedDiet through conferences, events and has introduced the 'Med Mark' in the US to help guide consumers in choosing traditional Mediterranean foods, drinks and other products. They have a website at http://www.oldwayspt.org.

1.2 Lifestyle factors

> *"We do not sit at table only to eat, but to eat together."*
>
> (Plutarch)

The traditional MedDiet, and its health benefits, cannot be fully understood without considering its cultural context. The 'Mediterranean food culture' (or 'Mediterranean lifestyle' as it is sometimes known) includes factors such as fixed meal times, eating as part of a social gathering and – in some countries – taking a siesta after the midday meal. Other lifestyle factors such as physical activity, not smoking, and low

Table 1.4 Breakfast ingredients in Mediterranean countries (adapted from [23]). With permission from Elsevier.

Country	Typical breakfast ingredients
Greece (rural)	bread, cheese, coffee, goat's milk, fruits, olives
Greece (urban)	coffee, milk, pastries, fruit juices, preserved fruits, eggs with ham and sausages, cheese, butter
Spain	coffee, pastries (*churros*)
Egypt (rural)	coffee or tea, bread, onion, salt
Egypt (Cairo)	coffee or tea, goat cheese, bread, broad beans (in a stew accompanied with eggs or smoked meat)
Italy	cappuccino, wheat biscuits, fruit
Turkey	Turkish coffee or tea, cheese, raw vegetables, olives

levels of stress have also been found to contribute to the overall health benefits of a MedDiet [20–22]. If one considers 'diet' in terms of its original meaning of 'a mode of living' from the Greek *diaita*, then the term 'Mediterranean diet' is completely congruous when implying the overall Mediterranean lifestyle.

The central part played by food in daily Mediterranean life is reflected in the care with which local, seasonal ingredients are sourced from respected producers and the care given to preparation and cooking. Producers themselves often sell their produce at local Mediterranean markets, and this promotes a close relationship between the consumer and the producer. This relationship helps maintain the quality of the produce and ensures that good agricultural practices are used, practices that can have a major impact on the nutritional value of the food (see Chapter 3).

1.2.1 Meal patterns

Meals are still an integral part of daily society in most Mediterranean countries, and the main meal is an important opportunity for bringing family members together. Lunch is still the main meal for many Mediterranean people, and many go home for lunch whenever possible, especially in Southern and Eastern countries [23]. However, the evening meal is increasingly becoming the main meal in regions where people work through the day or who work too far away from home to return there for lunch [23]. Breakfasts tend to be light compared to North European countries (Table 1.4), both in terms of quantity and in the low consumption of produce with high levels of saturated fats such as butter, sausages and bacon that typify the traditional English breakfast.

There is evidence that eating at fixed times during the day, and the associated periods when meals are not consumed, is important for inducing satiety which discourages excessive calorie intake [24]. This does not exclude the occasional consumption of snacks in traditional MedDiets (see Table 1.5), but whereas snacks in Northern Europe are a major source of salt, sugars, and saturated and trans fats [25], snacks in Mediterranean countries mostly consist of either fruit, nuts or home-made delicacies.

Table 1.5 shows a weekly food pattern collated from Cretans eating a traditional diet. During the week, the meal that included the main daily source of protein was mostly lunch, and this may particularly benefit physically active people, since studies have shown that optimal muscle building occurs when protein is eaten immediately after exercise [26]. By contrast, dinners were mainly based on easily digested cooked vegetables.

Table 1.5 Typical foods in a traditional Cretan Mediterranean diet consumed over a week [27]. With permission from Elsevier.

	Breakfast	Mid-morning	Lunch	Mid-afternoon	Dinner
Monday	ksinohontros[1], rusk, orange	pear	broad beans, onion, salad (cucumber, tomato, purslane, olives, olive oil), whole-wheat bread, apple, red wine	walnuts, dry figs	boiled vegetables, potatoes, olive oil, boiled egg, melon, red wine
Tuesday	rusk, cheese, apple	orange	snails, potatoes and vegetables, salad (tomato, cucumber, onion, olive oil), whole-wheat bread, red wine, longan	halva[2] (home-made)	rice with spinach, yogurt, whole-wheat bread, longan
Wednesday	doughnuts (homemade) with honey, apple, herbal tea	pear	chickpeas, herring, salad (tomato, cucumber, onion, olive oil), whole wheat bread, red wine	walnuts, figs, *raki*	stuffed tomatoes, whole wheat bread, salad (tomato, cucumber, onion), melon
Thursday	fresh whole milk boiled with ground wheat	melon	fish, broad beans (puree), oil, lemon juice, whole-wheat rusk, salad (tomato, cucumber, onion, olives, olive oil), pear, red wine	halva (home-made)	lentils, salad (tomato, cucumber, onion, olives, olive oil), apple, red wine, cheese, whole wheat bread
Friday	rusk, olives, herbal tea, apple	apple	beans, potatoes, whole-wheat bread, olives, orange	walnuts, dry figs, raki	broad beans, artichoke, olive oil, rusk, red wine, melon
Saturday	milk and whole wheat, melon	apple	chicken, okra, potatoes, salad (lettuce, cucumber, olives, olive oil)	home-made cheese pie, honey, coffee	boiled vegetables with olive oil, rusk, red wine, melon
Sunday	homemade cheese pie with honey, melon		rabbit, pasta, salad (tomato, cucumber, onion, olives, olive oil), rusk, wine, orange	coffee, halva	fish, fish soup with vegetables, rusk, red wine, apple

[1]Ksinohontros = yogurt, wheat; [2]halva = semolina, olive oil, sugar, walnuts.

1.2.2 Siestas

A siesta after a midday meal is still common in many Mediterranean countries. In Spain, most siestas were found to last for less than an hour. In a large study of healthy Greek men and women, working men who took a siesta were found to have fewer coronary deaths than those who did not nap [28].[1] The authors of this study suggested that regular siestas acted as a stress-reducing habit, which lowered the risk for CVD [28]. Not all studies, however, have found an inverse association between siestas and coronary deaths; indeed some studies have found a positive association. Taking a siesta is not conducted in a vacuum, and interpreting the data from some of these studies is subject to possible confounding factors. For example, people taking a siesta may take less physical exercise, which is a protective factor against CVD, and hence could give rise to a positive association between taking a siesta and CVD. Also, some individuals sleep during the day due to nightly sleep disturbances, which could be associated with underlying health problems. The Greek study did attempt to control for these possible confounding factors, although more studies examining the possible benefits of a siesta would be useful.

1.2.3 Physical activity

The high level of physical activity of the traditional Mediterranean peasant contrasts with the far more sedentary lifestyle of most present-day Mediterranean people. Despite this modern trend, the clement Mediterranean climate does still favour an outdoor lifestyle and more physical activity than is the case for many people living in more northern climates. In the HALE project, which evaluated the effects of a Mediterranean diet and lifestyle factors on mortality in elderly European men and women, physical activity was associated with a lower risk of all-cause mortality [22]. Increasing evidence is demonstrating that the health benefits of diet interact with other lifestyle factors, and physical exercise is now widely accepted to be an important factor that reduces the risk of age-related diseases such as CVD and some cancers [29]. A detailed study of Spanish children found that physical fitness is very important to reduce the risk of CVD and other diseases in later life, a point emphasised in the title of the paper: 'A Mediterranean diet is not enough for health' [30].

1.2.4 Sunshine

That Mediterranean countries are sunny is accepted almost without thought. But it has been argued that by inducing endogenous synthesis of vitamin D, sunlight is an important contributor to the health of Mediterranean people [31]. This proposal is based on recent evidence that the role of vitamin D in the body extends well beyond its role in bone health by preventing rickets and osteoporosis, and may also include a reduction in the risk for some cancers, hypertension and some immunological disorders (see Chapter 2).

1.3 Health benefits

There is a substantial body of epidemiological evidence for the health benefits of the MedDiet, and this is discussed fully in Chapters 10–13. A useful meta-analysis of a number of epidemiological studies generated the following estimates for the protective value of the MedDiet [32]:

[1] This analysis was not possible for women due to their lower incidence of coronary deaths.

- overall mortality reduced by 9%
- mortality from CVD reduced by 9%
- incidence of or mortality from cancers reduced by 6%
- incidence of Parkinson's disease and Alzheimer's disease by 13%

Other epidemiological studies show that there is some protection from other disorders including obesity, diabetes and metabolic syndrome [33], and these studies are also discussed in later chapters. Protection against CVD and cancers is the most significant in terms of reducing overall mortality.

The precise composition of the MedDiet that contribute to these protective effects continues to be an area of intense research interest. Key nutrients of the MedDiet that are thought to contribute to its beneficial effects include:

- high levels of MUFAs provided by olive oil
- high levels of PUFAs, especially *n*-3 fatty acids
- low levels of SFAs, and no TFAs from industrial sources
- high levels of plant-derived substances (including fibre, phytochemicals and vitamins)

A wide range of biologically plausible mechanisms has been elucidated that can explain how particular nutrients in the MedDiet may be protective against various disorders. This is a major theme of this book, and the evidence is discussed in later chapters.

1.3.1 Mediterranean dietary patterns

There is currently much interest in the relative health benefits of whole dietary patterns compared to individual dietary components [34, 35]. Although epidemiological studies can in some cases identify health benefits for individual foodstuffs, these studies do not give the complete picture. Rather, epidemiological evidence suggests that whole dietary patterns, such as a Mediterranean dietary pattern, should be considered for disease prevention, and that any one component is by itself insufficient to provide optimal health benefits [36–38]. For example, analysis of the Greek EPIC cohort found that adherence to a traditional Mediterranean diet was associated with a significantly reduced incidence of overall cancer, although there was not a statistically significant benefit simply from high consumption of fruits and vegetables [36]. This suggests that the overall dietary pattern was important in this study.

Figure 1.6 shows a comparison between the dietary patterns of Greece and the UK [39]. Compared to the UK, the Greek diet had a higher average consumption of olive oil, fruits, nuts and vegetables (although potatoes and red meat were also relatively high indicating a move away from a traditional MedDiet by the time of this 1999 analysis).

Clearly, the importance of the effect associated with a dietary pattern means that many dietary foodstuffs in this pattern may interact in a positive manner. In relation to CVD, this perspective has been summed up as follows: 'It is very likely that the ideal combination of the different dietary components with all the possible interactions and synergy is able to produce a maximum beneficial effect on all or, at least, the majority of mechanisms linking diet and cardiovascular disease, resulting in an enhanced reduction of cardiovascular disease risk' [40].

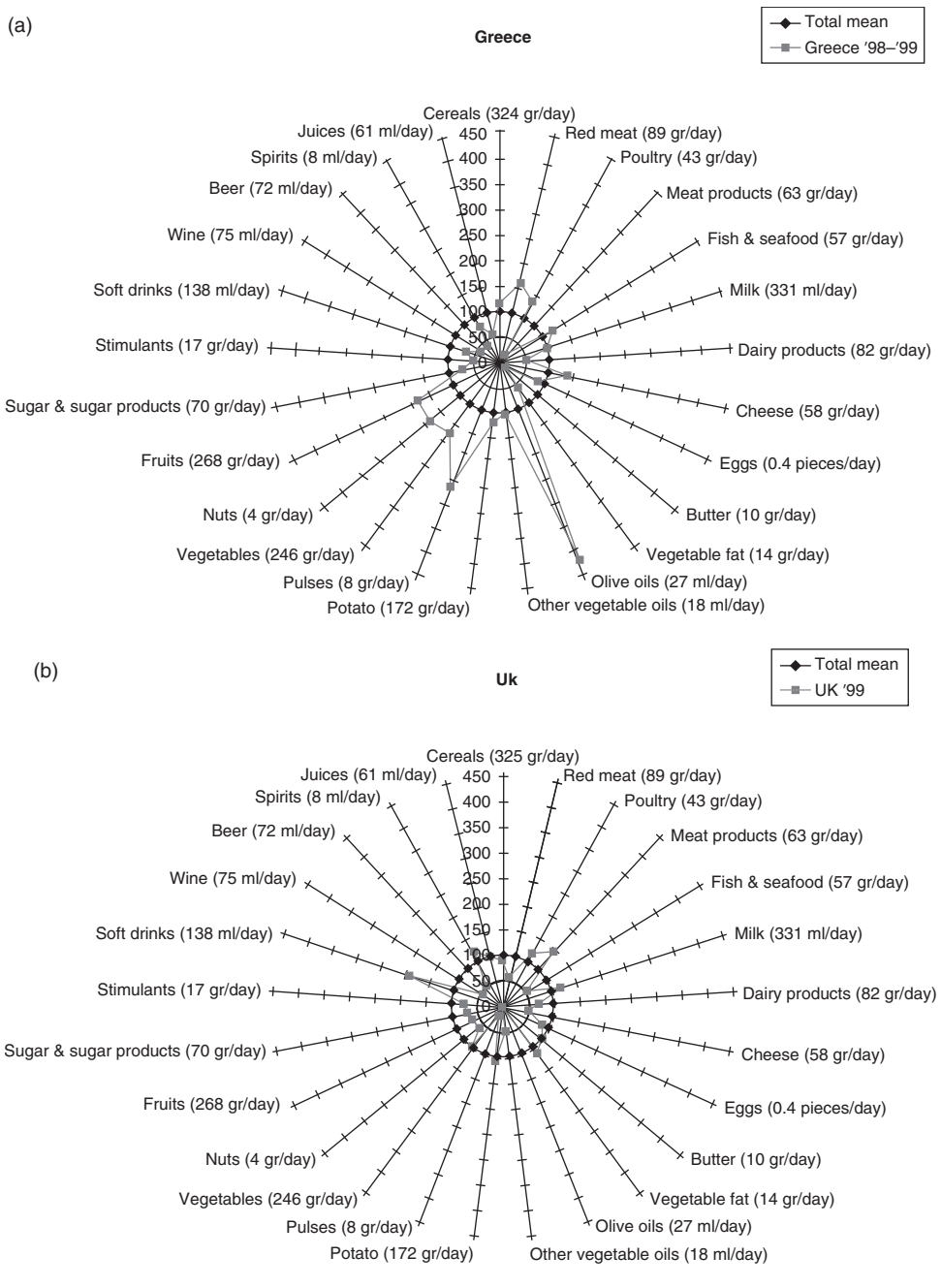


Figure 1.6 Dietary patterns of (a) Greece and (b) the UK in 1999 [39]. The reference circle of radius 100% indicates the mean for the Data Food Networking project (DAFNE) (absolute values are shown in brackets), and the second set of points indicates the % deviation of the food group from the reference DAFNE mean. Reprinted with permission from Macmillan Publishers Ltd, copyright 2006 Nature.

There are a plethora of candidate molecules that could contribute to the overall benefit of a traditional Mediterranean dietary pattern. However, establishing which molecules are involved is no trivial matter. A good illustration of the challenges that must be confronted is the estimate that up to 10,000 phytochemicals and their

breakdown products may be consumed as part of a diet rich in vegetables [41]. Elucidating the underlying mechanistic basis for synergistic protection between such a large number of potentially active dietary components represents a major challenge as there are clearly many potential opportunities for synergistic interactions between these phytochemicals [42]. An illustration of the possible complexities is that over 1600 compounds have been identified in grapes, of which only a fraction have been studied in any detail [43]. Extending this to the overall MedDiet greatly amplifies the possible number of interactions between constituents in the different foods and their metabolic products.

1.3.2 Endorsements

Several health bodies have now endorsed the MedDiet. These endorsements have been prompted not only because of the well-established health benefits of the MedDiet, but also because people enjoy eating a MedDiet and so show a high degree of compliance when asked to maintain this dietary pattern over a period of time. In relation to CVD, there is evidence that the MedDiet is useful not only for primary prevention, but may also be beneficial for secondary prevention (i.e. after a first episode) of CVD [40]. Both the American Heart Association (AHA) and British Heart Foundation (BHF) have given endorsements of the MedDiet. The AHA Science Advisory and Coordinating Committee stated that 'it would be short-sighted not to recognize the enormous public health benefits that the Mediterranean-style diet could confer' [44]. The British Heart Foundation in one of its leaflets (2/99) states that 'Positive advice to eat more fish, fruit and vegetables or to eat a more Mediterranean diet rather than simply recommending a reduction in saturated fat may be more effective at reducing mortality in patients with existing coronary heart disease'. And The British Dietetic Association also specifically recommends the MedDiet for people with coronary vascular disease or who have had a heart attack [45].

Although endorsements in relation to cancer prevention are less explicit, the MedDiet is in line with general dietary recommendations, such as high fruit and vegetable consumption and low consumption of saturated fat and red meat.

1.4 The MedDiet, past, present and future

1.4.1 Current trends

Since the early 1960s, the period when the MedDiet was first delineated by the epidemiologist Ancel Keys, there have been significant changes in eating habits in Mediterranean countries. The diet in Mediterranean countries has progressively become much more similar to that of North European countries in terms of meat and dairy produce consumption, although on average there is still a higher consumption of fruit, vegetables and cereals (Table 1.6).

The progressive departure from a traditional MedDiet is particularly evident in children and young adults. This is of significant public health concern since it is thought that moving away from a MedDiet is contributing to the large rise in the incidence of obesity in the young in many Mediterranean countries [47].

A number of different scoring systems have been developed in order to assess adherence to the MedDiet (see Chapter 8). One of these is the Mediterranean Adequacy Index (MAI) which measures the ratio of energy obtained from foodstuffs

Table 1.6 Mean availability (g per capita per day) of selected food groups in Mediterranean countries and the rest of the 15-country EU in the early 1960s and early 1990s [46]. With permission from Cambridge University Press.

	Fruits	Vegetables	Legumes	Cereals	Meat	Dairy produce	Vegetable oils: animal fats	Alcoholic beverages
1960s								
Mediterranean	264	416	19	435	105	376	6.3	274
Rest of EU	217	215	6	288	189	583	0.1	332
1990s								
Mediterranean	341	500	16	372	248	599	4.4	245
Rest of EU	279	257	7	272	236	682	0.2	360



Figure 1.7 MAI in European and North African countries 2000–2003 [48]. 00–0.99; 1.00–1.99; 2.00–2.99; 3.00–3.99; 4.00–4.99. With permission from Cambridge University Press.

associated with the MedDiet divided by energy obtained from animal foodstuffs and processed foods. Hence a high value indicates better adherence to the MedDiet:

$$\text{MAI} = \frac{\begin{array}{l}\%\text{ of energy (bread + cereals + legumes dry and fresh}\\ \text{+ potatoes* + vegetables + fresh fruit + nuts + fish}\\ \text{+ wine + vegetables oils)}\end{array}}{\begin{array}{l}\%\text{ of energy (milk + dairy products + meat + eggs}\\ \text{+ animal fats and margarines + sweet beverages}\\ \text{+ cakes, pies, and cookies + sugar)}\end{array}}$$

The MAI has been used to assess adherence of the MedDiet in various countries of the world (Figure 1.7) [48].

In addition, the MAI has been used to monitor changing trends. Most Mediterranean countries showed a decrease in their MAI scores between the period 1961–1965 and the period 200–2003 (Figure 1.8). By contrast, some countries, such as Iran, the UK, Sweden, Denmark and Norway, showed an increase in their MAI, although their overall pattern is still a long way from a true MedDiet pattern as can be seen by their absolute MAI values (Figure 1.7). Egypt had highest MAI in 2005. So does this mean that Egyptians are particularly free of chronic degenerative disorders? Unfortunately, the answer is no. The average life expectancies for men and women in Egypt are only 66 and 70 years respectively (WHO, 2006 figures), and the major killer is CVD,

* Potatoes are not included in most estimates of the MedDiet.

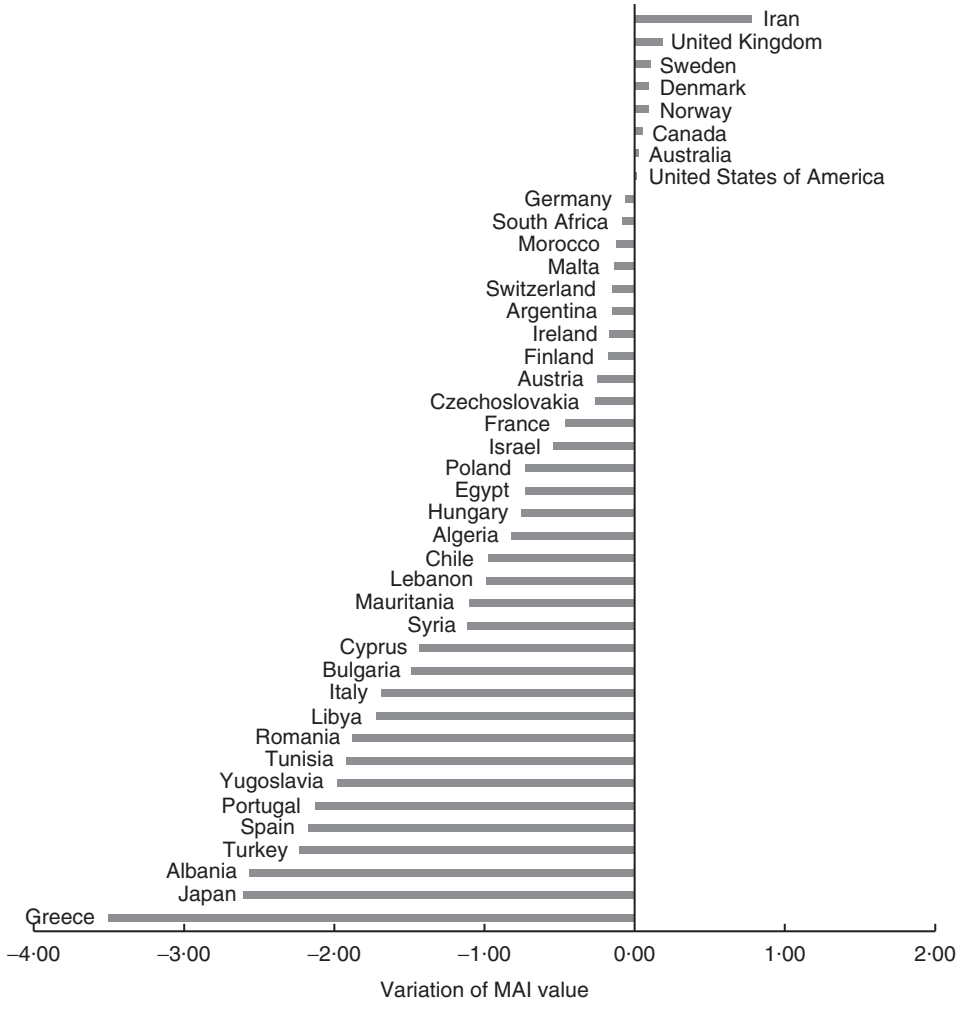


Figure 1.8 Changes to Mediterranean Adequacy Index 1961–1965 and 2000–2003 [48]. With permission from Cambridge University Press.

accounting for 34% of all deaths (WHO, 2006 figures). These figures may appear contradictory since the MedDiet is quintessentially associated with protection against CVD. There are important lessons from these figures as they highlight the limitations of the MAI[2]. Egypt is a low income country compared to Europe and the US, and the diet emphasises vegetables, pulses and has a relatively low meat consumption, and this eating pattern is reflected in the high MAI. However, consumption of two other key components of the MedDiet, namely olive oil and fish, is low, whereas by contrast saturated fat consumption is high due to the popularity of cooking with clarified butter (known as *samna* in Egypt). These figures are an argument in favour of emphasising the importance of the *whole* dietary pattern in reducing the risk of CVD, although other factors, such as smoking and health care access, could also be important.

[2] Similar reservations may also apply to other scoring systems for adherence to a MedDiet.

Many factors have been suggested that could contribute to changes in eating patterns in Mediterranean countries, and these include:

- Increased costs of some traditional Mediterranean foods (e.g. fish, olive oil). Depletion of fish from the Mediterranean sea has reduced consumption in Greece and Italy. However, fish consumption in Spain is still high – mostly due to using alternative supplies of fish from the Atlantic ocean and fish farming.
- Aspects of modernity [49]:
  - Changes in working patterns. This often results in fewer opportunities for a traditional lunch-time meal. Also, many modern jobs require far less physical activity than was the case in traditional Mediterranean society. Women working was associated with a decrease in consumption of pulses.
  - Increased availability of cheap industrialised foods.
  - New household appliances, which change food preservation and cooking techniques.
  - Migration
  - Tourism

Some of these changes particularly impact on poorer socio-economic groups whereas, by contrast, some are associated with increased purchasing power.

1.4.2 The Greek experience

Greece had the highest MAI in 1960–1965 (5.54) but this had decreased by 3.5 points by 2000–2005. This represents the largest reduction in adherence to the MedDiet over the last 40 years of any country (see Figure 1.8). Greece is also currently experiencing a dramatic rises in obesity rates, and it is estimated that one in five men and one in six women in Greece are now obese, and that approximately half the men and one-third of the women in Greece are overweight [50]. The situation is now serious in Greek children [51], and even Greek medical students have high rates of obesity [52]. Overall, Greece now has one of the highest rates of obesity in the developed world (Table 1.7).

Table 1.7 Obese population aged 15 and above. Data based on OECD (2010), 'Obesity', in OECD, *OECD Factbook 2010: Economic, Environmental and Social Statistics*, OECD Publishing, http://dx.doi.org/10.1787/factbook-2010-87-en

Country	Females	Males
France	10.4	10.5
Germany	12.8	14.4
Greece	18.3	14.3
Italy	9.2	10.6
Japan	3.3	3.4
Netherlands	12.2	10.2
Spain	14.7	15.1
Turkey	14.5	9.7
United Kingdom	24.4	23.6
United States	35.3	33.3

Limitations of comparing international obesity statistics

Comparisons of health statistics between countries is often fraught with difficulties due to differences in the way data are collected. In the case of obesity, data may be collected by experts or from self-reported surveys. However, self-reporting frequently underestimates the true situation. In addition, there is the consideration of whether or not to compensate for non-responders to self-reporting surveys: some countries do this but not others. Other differences between data from countries can include the age ranges that have been surveyed, and the year in which the data was collected. Hence national obesity figures only give a general indication of comparative obesity rates.

Several studies have been undertaken to examine whether the rise in obesity in Greece is linked to changing dietary patterns. Although the traditional Greek diet is often considered to represent the quintessential MedDiet, there have been major changes in eating patterns within the last generation. There is some evidence that reduced adherence to the MedDiet is linked to the rise in obesity in Greece [53], although the rise in obesity is also linked to reduced levels of physical activity and changes in socio-economic factors. The overall Greek population showed an increase in average calorie intake from 2900 kcal/per person/per day in the mid 1960s to 3700 kcal/per person/ per day by the 21st century, much of which can be attributed to increased consumption of animal fats [54]. There has also been a significant decline in physical activity. Socio-economic factors may also play a part in the large rise in obesity in Greek children: children are subject to high exposure of advertising for fast foods, and fat babies are still often seen as more desirable than thin children, possibly a legacy of deprivations during the Second World War. However, consumption of some traditional components of the MedDiet in Greece, such as olive oil and fruits and vegetables, is still high.

The rise of obesity in Cretans farmers is particularly poignant. Cretan farmers living in the 1960s were highlighted in the Seven Countries Study by Ancel Keys as representing a gold standard of healthy living, and this was attributed to a combination of their diet and relatively high levels of physical activity. In the 1960s their mean BMI was 22.9kg/m^2 (average weight 63 kg) for the 40–59 age group, but this had increased to a mean BMI of 29.8 kg/m^2 (average weight 83 kg) by 2005 [55]. Energy intake cannot explain these changes since this *decreased* from 2820 kcal in the 1960s to 2412 kcal in 2005. Rather, the large reduction in physical activity from the 1960s to the 1990s is thought to be a contributory factor coupled with the low awareness on matters of health and diet of this socieconomic group [55].

1.4.3 Not all bad news

Although many Mediterranean countries are seeing a decrease in adherence to the MedDiet, other parts of the world have seen an increase in consumption of foods associated with the MedDiet. For example, much of the expansion in world consumption of olive oil over the last few years has been in non-Mediterranean countries such as the US, Northern Europe, Japan, Australia and Brazil. The availability of many foods associated with the MedDiet, such as olive oil, fruit and cereals, increased in non-Mediterranean northern Europe between the periods 1961–1965 and 2000–2004 [56].

1.4.4 Future prospects

The MedDiet is well placed to benefit from current consumer concerns related to eating and health due to the high consumption of fruits and vegetables, moderate consumption of dairy products and low consumption of red meat. In addition, its environmental impact is relatively low: Many Mediterranean foods can be grown locally (less 'air-miles'), and Mediterranean agriculture is associated with a lower production of greenhouse gases due to the low use of cattle raised under intensive conditions [57]. Indeed, even traditional Mediterranean foods such as Italian cheeses and hams are now being produced in the UK! [58]

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