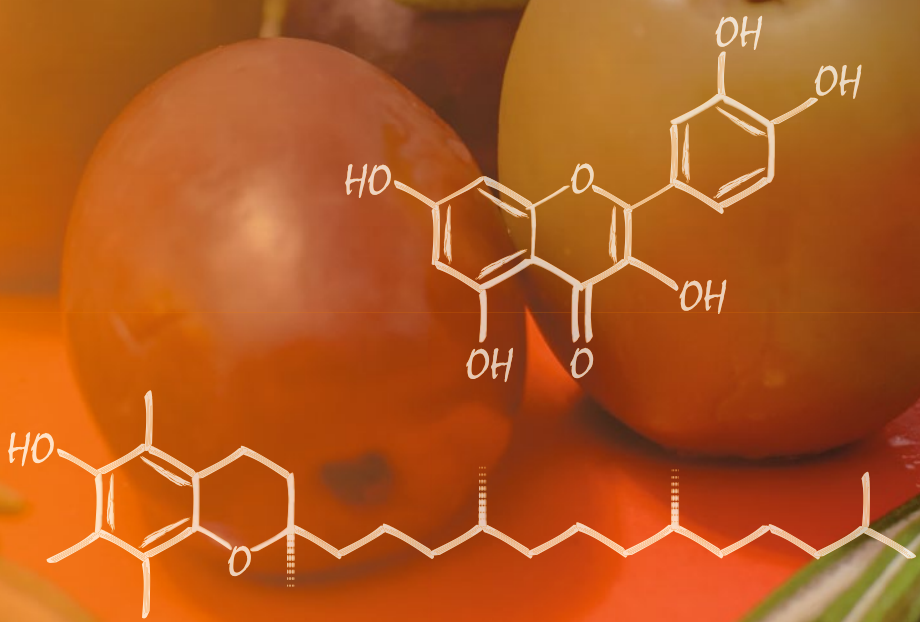
Amélia Martins Delgado
Maria Daniel Vaz Almeida
Salvatore Parisi

Chemistry of the Mediterranean Diet



Springer

Chemistry of the Mediterranean Diet

Amélia Martins Delgado •
Maria Daniel Vaz Almeida •
Salvatore Parisi

Chemistry of the Mediterranean Diet

Springer

Amélia Martins Delgado
Consultant for Food Safety
and Nutrition
Lisbon, Portugal

Maria Daniel Vaz Almeida
Faculty of Nutrition and Food Sciences
University of Porto
Oporto, Portugal

Salvatore Parisi
Associazione 'Componiamo il Futuro' (CO.I.F.)
Palermo, Italy

ISBN 978-3-319-29368-4 ISBN 978-3-319-29370-7 (eBook)
DOI 10.1007/978-3-319-29370-7

Library of Congress Control Number: 2016945570

Photographs and cover illustration by Tobias N. Wassermann.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

Acknowledgments

AMD wishes to express her gratitude to Prof. Pedro Louro, Head of the Research group on Dairy Technology, INIAV—IP, for his review of 2.3 and his valuable suggestions; to Eng. Vitor Barros, Principal Researcher of INIAV, IP, and coordinator of the Portuguese committee for the application to UNESCO's MD's representative list, for the supply of useful documentation and other resources; to Eng. Fernando Severino, Regional Director of Agriculture, and member of the Portuguese committee for the application to UNESCO's MD's representative list, for his friendly support;

"Let food be your medicine and medicine be your food." (Hippocrates)

Contents

Abbreviations

ABA	Abscisic acid
ALA	α-Linolenic acid
a_w	Water activity
bw	Body weight
Ca	Calcium
CHD	Coronary heart disease
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
CLA	Conjugated linoleic acid
Con A	Concanavalin A
Cu	Copper
DGAC	Dietary Guidelines Advisory Committee
DHA	Docosahexaenoic acid
DNA	Deoxyribonucleic acid
DPA	Docosapentaenoic acid
EC	European Council
EFSA	European Food Safety Authority
EGCG	(−)-epigallocatechin-3-gallate
EOL	Encyclopedia of Life
EPA	Eicosapentaenoic acid
EU	European Union
EUFIC	European Food Information Council
EVOO	Extra virgin olive oil
F	Fluorine
FAO	Food and Agriculture Organization of the United Nations
FBS	Food balance sheet
FDA	US Food and Drug Administration
Fe	Iron
FIL/IDF	Fédération International de Laiterie/International Dairy Federation
G6PD	Glucose-6-phosphate dehydrogenase
GI	Gastrointestinal
GLA	Cis-γ-linolenic acid
GRAS	Generally recognised as safe

HDL-c	High-density lipoprotein cholesterol
ICO	International Coffee Organization
INSA	Instituto Nacional de Saúde Doutor Ricardo Jorge
IOOC	International Olive Oil Council
IPP	Isoleucine-proline-proline, tripeptide
IUPAC	International Union of Pure and Applied Chemistry
KIDMED	Mediterranean diet quality index for children and adolescents
LA	Linoleic acid
LAB	Lactic acid bacteria
LD_{50}	Lethal dose
LDL	Low-density lipoprotein
LDL-c	Low-density lipoprotein cholesterol
LPS	Lipopolysaccharide
MAI	Mediterranean adequacy index
MD	Mediterranean diet
MDS	Mediterranean diet score
MEDAS	Mediterranean diet adherence screener
Med-DQI	Mediterranean dietary quality index
MEFA	(n-3) fatty acid
Mg	Magnesium
Mn	Manganese
MUFA	Monounsaturated fatty acid
Na	Sodium
NaCl	Sodium chloride
NCBI	National Center for Biotechnology Information
NCD	Non-communicable disease
NHS	National Health Service
NLM	National Library of Medicine
OA	Oleic acid
OVOO	Ordinary virgin olive oil
P	Phosphorus
PAF	Platelet activating factor
PDO	Protected designation of origin
PEITC	2-phenethyl isothiocyanate
PhIP	2-amino-1-methyl-6-phenylimidazo(4,5-b)pyridine
PortFIR	Portuguese Food Information Resource
PUFA	Polyunsaturated fatty acid
RAE	Retinol activity equivalent
ROS	Reactive oxygen species
Se	Selenium
SFA	Saturated fatty acid
t11	Δ11 trans
t9	Δ9 trans
TCA	Tabela da Composição de Alimentos
TFA	Trans-fatty acid(s), trans-fats

UN	United Nations
UNESCO	United Nations Education, Scientific and Cultural Organization
USA	United States of America
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
VOO	Virgin olive oil
VPP	Valine-proline-proline, tripeptide
WHO	World Health Organization
WHO-ROEM	World Health Organization-Regional Office for the Eastern Mediterranean
Zn	Zinc

Part I

Introduction to the Mediterranean Diet

The Mediterranean Diet: What Is It?

1

Abstract

The Mediterranean basin and the Iberian Peninsula constitute a vast geographical area where three continents intercept. Ancient civilizations characterised by cultural and religious diversity flourished in the region. The Mediterranean diet (MD) represents unity in diversity, integrating food habits with cultural habits (such as the convivial aspects of meals), landscapes (such as the presence of olive orchards and vineyards), and food preservation methods. The concept of the MD was first coined by Ancel Keys, an American physician who highlighted the health benefits of the food pattern of southern Europeans after World War II. The MD is now recognized as one of the most healthy food patterns in the world. This book takes as reference the evolution of the original concept by Ancel Keys, as well as the countries that are currently included in the United Nations Educational, Scientific and Cultural Organization Representative List (Portugal, Spain, Morocco, Italy, Greece, Croatia and Cyprus), which classifies the MD as an 'intangible heritage of humanity'. This chapter discusses the origins and primary features of the MD, mainly from a dietary perspective.

1.1 The Mediterranean Diet: An Introduction

The Mediterranean diet (MD) constitutes a paradigm that inspires healthy dietary recommendations worldwide. The concept of the MD, 'diet' being from the Greek *diaita* ('way of life') or the Latin *diaeta* ('prescribed way of life'), is wider than just a food pattern and includes lifestyle and traditions. Ancel Keys and co-workers in the 1950s were the first to establish the link between the MD and health by showing an inverse correlation between adherence to the MD and the incidence of coronary heart disease. Keys described the MD as a dietary pattern and lifestyle observed in southern Europe just after World War II, consisting of frugal meals with wheat, wine and olive oil as key elements. He described meals as communal events that included many vegetables and herbs and very small amounts of meat and fish, with

A.M. Delgado et al., *Chemistry of the Mediterranean Diet*,
DOI 10.1007/978-3-319-29370-7_1

pulses and cheeses as the preferred sources of protein. Cooking methods were simple, despite the resulting variety of flavours and colours. Seasonal fruits were the preferred desserts, and nuts and olives were eaten as snacks. Coffee and tea played an important role in these communal meals, and sweet desserts were reserved for festivities, when the intake of meat and fish was also increased. The United Nations Education, Scientific and Cultural Organization (UNESCO) classified the MD as an 'intangible heritage of humanity', aiming to call attention to and preserve this pattern. Countries that make up the Representative List in 2015 are Portugal, Spain, Morocco, Italy, Greece, Cyprus and Croatia. This chapter discusses time trends in dietary habits, based on data from the United Nations Food and Agriculture Organization's Food Balance Sheets and literature reviews of diet indexes and epidemiological and cohort studies. A Westernisation of food habits has been recognized in the area, characterised by a high-energy diet, with increasing consumption of industrially processed foods. These foods usually contain large amounts of salt, simple sugars, saturated and trans fats, which industries offer in response to consumers' demands. Consequently, the intake of complex carbohydrates, fibres, fruits and vegetables has decreased. The energy and animal proteins consumed largely exceed World Health Organization recommendations, while, generally, a smaller variety of foods is being consumed. Adherence to the MD dietary pattern has been rapidly decreasing in the area since 2000, particularly in Greece, Portugal and Spain. These observations point to a nutrition transition period that encompasses considerable changes in diet and physical activity patterns, which may be leading to an increase in the incidence of chronic and degenerative diseases. Recent epidemiological and metabolic studies support that the adoption of MD-like dietary patterns results in better overall health status and self-perception of well-being. A reversal of the decreasing adherence to an MD will require an approach at various levels and in a wide range of settings. The acquisition of healthy food habits during childhood and the development of cooking skills may contribute to ensuring the long-term implementation of MD.

1.2 The Concept of the Mediterranean Diet

The Mediterranean basin is the region surrounding the Mediterranean Sea, where Europe, Asia and Africa intercept. There are 23 internationally recognised countries in the Mediterranean area: Portugal, Spain, France, Monaco, Italy, Malta, Slovenia, Croatia, Bosnia-Herzegovina, Montenegro, Albania, Greece, Cyprus, Macedonia, Syria, Turkey, Lebanon, Israel, Egypt, Libya, Tunisia, Algeria, and Morocco. Figure 1.1 shows the Mediterranean region, highlighting the countries that currently represent the 'Mediterranean Diet' of UNESCO: Portugal, Morocco, Spain, Italy, Greece, Croatia and Cyprus.

Prominent ancient civilizations ascended in the region. The mild climate is ideal for the cultivation of olive trees and vineyards, which shaped the landscape, culture and traditions, including food habits. Braudel, a recognised French historian (1912–1985), approached history from the perspective of the common man. His

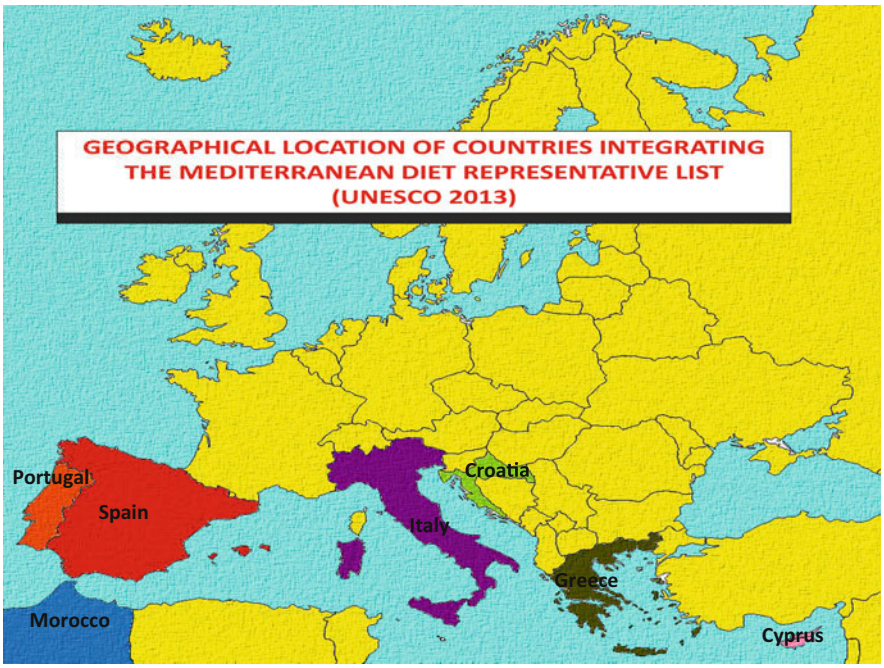


Fig. 1.1 Mediterranean Region and countries integrating the representative list of 'Mediterranean Diet' of UNESCO (UNESCO 2013)

notable work about the geohistory of the Mediterranean region remains a reference. In Braudel's approach, the region is treated, in an interdisciplinary manner, as a whole, irrespective of religious and national divides (Piterberg et al. 2010). Braudel and his followers consider that the Mediterranean region spans from the first olive tree in the north to the first compact palms in the desert. The area surrounding the Mediterranean Sea exhibits large geographical, economic, political, cultural, ethnic and religious diversity which, in turn, influences the food practices and habits of the region's inhabitants. The dietary patterns of Mediterranean peoples and their association with health, wellbeing and longevity have stimulated much research from different scientific disciplines, such as biochemistry, nutrition, genetics, general medical sciences, sociology, anthropology and history.

As Trichopoulou and Lagiou wrote, 'The Mediterranean diet and lifestyle were shaped by climatic condition, poverty and hardship rather than by intellectual insight or wisdom. Nevertheless, results from methodological superior nutritional investigations have provided strong support for the dramatic ecologic evidence represented by the Mediterranean natural experiment' (Trichopoulou and Lagiou 1997).

The broader definition of the MD is (UNESCO 2013): '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'. Substantially, the MD is based on a nutritional model without important temporal or geographical variations: three pilasters—wheat, olive oil and wine—must be considered (CIHEAM 2012). In addition, the MD encompasses more than simply food because of the indubitable correlation with social life and cultural heritage. 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. The key role of women in transmitting the expertise, rituals, traditional gestures, celebrations, and the safeguarding of techniques, is to be highlighted. The practical demonstration of these assumptions can be observed in Mediterranean cities such as Tavira in Portugal, Koroni in Greece, Chefchaouen in Morocco, Cilento in Italy and other sites (UNESCO 2013).

When, in the 1950s, Keys started his studies in Italy and later published the book *How to Eat Well and Stay Well, the Mediterranean Way*' (Keys and Keys 1975), he probably could not have anticipated that the concept he and his co-workers coined as the 'good Mediterranean diet' would be considered, half a century later, patrimony of mankind. This occurred in 2010, when the MD was classified by UNESCO as an 'Intangible Cultural Heritage of Humanity' to help demonstrate the diversity of this heritage and to raise awareness about its importance, thereby contributing to its safeguarding. The corresponding Representative List of countries (Spain, Italy, Greece, Cyprus and Morocco) was amended in 2013 to include Portugal and Croatia.

An intangible cultural heritage is 'traditional, contemporary and living at the same time'; it is *inclusive* because of the preservation of identity, generation after generation, sometimes influenced by migratory flows and the effect of different (non-native) environments; *representative* because of the historical knowledge of community rituals and behaviours and their adoption by other communities; and *community based* because of the conscious awareness of community members (UNESCO 2013).

The concept of the MD is thus multidisciplinary, encompassing culture, climate, history, and sociology, as well as food habits. Approaches to the MD beyond nutritional aspects, dietary patterns, and food composition, and their relation to health and wellness, fall outside the scope of this book.

References

CIHEAM (2012) The Mediterranean diet for sustainable regional development. Presses de Sciences Po, Paris

Keys AB, Keys M (1975) How to eat well and stay well the Mediterranean way. Doubleday, London

Piterberg G, Ruiz TF, Symcox G (eds) (2010) Braudel revisited—the Mediterranean world 1600-1800, vol 13, UCLA Clark Memorial Library series. University of Toronto Press, Toronto

Trichopoulou A, Lagiou P (1997) Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. Nutr Rev 55(11):383–389. doi:10.1111/j.1753-4887.1997.tb01578.x

UNESCO (2013) Intangible Cultural Heritage. Representative List. Intergovernmental Committee for the safeguarding of the Intangible Cultural Heritage. Convention for the safeguarding of the Intangible Cultural Heritage. EN Title: Mediterranean diet. Nomination file no. 00884 for inscription in 2013 on the representative list of the Intangible Cultural Heritage of Humanity, Baku. RL 2013:1–30. Available at http://www.unesco.org/culture/ich/doc/download.php?versionID=20926. Accessed 30 Oct 2015

WHO (2015) Programmes and projects. Nutrition. Nutrition health topics. 3. Global and regional food consumption patterns and trends. Available at http://www.who.int/nutrition/topics/3_foodconsumption/en/. Accessed 30 Oct 2015

WHO-ROEM (2012) Promoting a healthy diet for the WHO Eastern Mediterranean Region: user-friendly guide. WHO Regional Office for the Eastern Mediterranean, Cairo. Available at http://applications.emro.who.int/dsaf/emropub_2011_1274.pdf?ua=1. Accessed 30 Oct 2015

Food and Nutrient Features of the Mediterranean Diet

2

Abstract

This chapter describes the Mediterranean food pattern as rich in vegetables and characterised by a high consumption of olive oil and a reduced intake of meat and dairy products, particularly liquid milk. The so-called good Mediterranean diet corresponds to the dietary pattern found in the olive-growing areas of the Mediterranean region. The concept is linked to rural communities experiencing a period of economic depression after World War II and before the wide dissemination of the fast-food culture. Despite regional variations, common components and cultural aspects can be identified, namely olive oil as the main source of lipids, the consumption of large amounts of seasonal vegetables, fruits and aromatic herbs (some of them gathered from the wild), as well as small intakes of meat and fish, often replaced or complemented with pulses, as sources of protein. Several global and governmental organizations acknowledge the Mediterranean diet as nutritionally adequate, health-promoting and sustainable because of its emphasis on biodiversity and the intake of small meat portions. In short, Mediterranean-style dietary patterns score highly for health, as well as for estimated sustainability scores, and can be followed in Mediterranean as well as in non-Mediterranean countries.

2.1 The Mediterranean Diet: Food and Nutrient Features

The Mediterranean diet (MD) as a dietary pattern, and its relation to public health, was first noticed and extensively studied by Ancel Keys, an American medical doctor who travelled to Naples in the early 1950s, establishing the concept of what he later called the 'good Mediterranean diet' (Grande et al. 1965, 1972; Keys 1995; Keys et al. 1980). Keys and co-workers conducted an extensive epidemiological study known as the 'Seven Countries Study' from the middle 1950s to the late 1970s in seven countries: the USA, Finland, Netherlands, Italy, Greece, Japan and former Yugoslavia—now Croatia and Serbia. The study established a correlation

A.M. Delgado et al., *Chemistry of the Mediterranean Diet*,
DOI 10.1007/978-3-319-29370-7_2

between blood cholesterol levels and the risk of coronary heart disease (Keys and Fidanza 1960; Keys et al. 1980). In the 1960s, coronary deaths in the USA and northern Europe greatly exceeded those in southern Europe, even after controlling for age, cholesterol and blood pressure levels, smoking, physical activity and weight. The Seven Countries Study also showed that cardiovascular risk factors in midlife are significantly associated with increased risk of dementia later in life (Keys et al. 1980). The importance of eating patterns became clear, and Keys described 'the good Mediterranean diet' as mainly vegetarian, characterised by a high consumption of olive oil and reduced intake of meat and dairy products, particularly liquid milk, when compared with the dietary habits of northern Europe and the USA. The diet characterised by Keys (Grande et al. 1972; Keys and Keys 1959; Keys et al. 1980; Keys 1995) and other authors (Bach-Faig et al. 2011; Georgoulis et al. 2014; Trichopoulou and Lagiou 1997; Trichopoulou et al. 1995) mainly corresponds to the dietary patterns found in the olive-growing areas of the Mediterranean basin, mainly of rural communities experiencing a period of economic depression after World War II and before wide dissemination of the fast-food culture. There are several variants in the region, but some common components and cultural aspects can be identified, namely olive oil as the main source of lipids; the consumption of large amounts of seasonal vegetables, fruits and aromatic herbs (some of them gathered from the wild); as well as commensality since meals are a communal event.

According to several authors (Keys 1995; Trichopoulou and Lagiou 1997), this dietary pattern included the daily consumption of olive oil, which accounted for most of the energy intake. Tree nuts and table olives were also commonly consumed. Large quantities and varieties of vegetables, legumes and fruits supplied vitamins, fibres and antioxidants. Beans, peas, and cheese were important sources of protein. Meat and fish were consumed in very small amounts. Wheat, potatoes and rice (mostly minimally processed) constituted the carbohydrate sources. Liquid milk was not commonly consumed by adults. It is noteworthy that Trichopoulou and Lagiou (1997) stressed the role of moderate wine consumption during meals, as have other authors more recently (Covas et al. 2010; Jordão et al. 2010; Nishizuka et al. 2011; Opie et al. 2011).

As observed by Keys and co-workers (Grande et al. 1972; Keys 1995), a classical meal always included a large amount of cooked and/or raw vegetables. Typical examples are salads that include a large variety of leaves and herbs, seasoned with olive oil. Meat was absent or consumed only in very small amounts. Red wine was most often present in adult's meals, except in Muslim countries. Cakes and other sweet desserts were reserved for special occasions, and seasonal fruit was the typical dessert. Besides olive oil, bread, cheese and wine are described as playing central roles in this diet (Keys 1995; Keys et al. 1980). For cultural and religious reasons, green tea with mint is most consumed in Muslim countries, and may, in some aspects, act as wine's counterpart due to its composition, as we show in Part II.

To lay people, the term 'diet' generally means the food and drink consumed by individuals or population groups, but it is even more commonly associated with

voluntary food restriction. However, the original Greek word *diaita* meant 'way of life' and the Latin word *diaeta* 'prescribed way of life', therefore encompassing food habits, daily activities, culture and lifestyle. When the pioneering works of Keys found an association between several health aspects (longevity, low morbidity and mortality from coronary heart disease and cancer) and what they later coined as the good Mediterranean diet, such characteristics were also registered. Therefore, occupational and leisure activities, adaptation to geographical and weather conditions as well as dependence on local resources and balance between people and the ecological system were as important to the broad concept of the MD as the food and drink included in the daily choices of individuals. It is worth mentioning that the communities investigated by Keys lived simple lives with hard occupational activities leading to high energy expenditure within a framework of food scarcity shaped by seasonal variances. Scarcity was the rule; abundance was the exception that led to festivities (cultural, religious) when people indulged in eating and drinking. Therefore, engaging in demanding occupational activities, under the direct influence of weather conditions and adapting to seasonal variations, constitute a common ground for the food and nutrient features of the MD.

As an expression of culture, history and lifestyle, several elements characterise the MD:

- Daily food intake distributed as four or five meals according to season and in proportion to labour intensity
- First and second daily meals (breakfast and lunch) were more important than the evening meal (dinner)
- Meal sharing, in a calm and peaceful environment
- A large diversity of foods, in small quantities, constituting a variety of textures and tastes
- Seasonal, locally produced and minimally processed foods
- Simple cooking methods
- Marked distinction between common days and festivities

The food features of the MD include the following:

- High fruit and vegetable consumption (unprocessed)
- High intake of wholegrain cereals, pulses and nuts
- Garlic, onions and olives all year round
- Olive oil as the 'central' fat
- High fish intake depending on proximity to the sea
- Low intake of red and processed meats
- Preference for white meat, especially poultry
- Moderate intake of dairy foods, with a preference for cheese and yoghurt
- Regular but moderate intake of alcoholic drinks, particularly wine at meal times

The analysis of such food patterns reveals the nutritional characteristics described in Table 2.1.

Table 2.1 Main nutritional features of the Mediterranean Diet

Nutrients	% Total energy intake	Particularities
Carbohydrates	60–70	Of which 50 % starch
Protein	Around 10	Of high biological value; pulses and other vegetables as relevant sources
Lipids	20–32	Monounsaturated fatty acid: oleic acid from olive oil and nuts
		Polyunsaturated fatty acid ratio n-6:n-3 = 1–2:1 from fatty fish, nuts versus vegetable seed oils, margarine
		Modest saturated fatty acid intake
Alcohol	Null	Alcoholic drinks are forbidden in the Muslim religion
	4–7	Mainly from wine, during meals
Fibre	Not applicable	Rich in soluble and insoluble fibre, from fresh fruit, vegetables, wholegrain cereals and nuts

As mentioned above, seven countries are included in the United Nations Education, Scientific and Cultural Organization (UNESCO) MD Representative List in 2015: Portugal, Spain, Morocco, Italy, Greece, Cyprus and Croatia. Data from the corresponding Food Balance Sheets (FBS), obtained from the UN Food and Agriculture Organization (FAO), were compared to illustrate the above observations and to obtain information on time trends in food consumption, merging information with studies that infer deviations by applying diet quality indexes (FAO 2015a). The evolution of dietary patterns, and tools available to assess such changes, are the object of the next chapter. FAO FBS from 1961 until 2011 are publicly available. No information about Croatia exists before 1992, thus reducing the time span under analysis in that country, as shown in Figs. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7.

Food availability compiled by the FAO in FBS provides an estimate of the food available for human consumption in a country for a certain period of time, usually 1 year. Total food availability is computed from statistical data on supply (internal production, imports and stock changes), utilisation (exports, feed, seed, industrial use and non-food uses), and changes in stocks during the same period. The per capita value is obtained by dividing the annual quantity of each food group by the total population of the country in the same period. Therefore, the daily energy availability (kjoules or kcal/person/day) is an indirect estimation of food available for human consumption (FAO 2015b).

The FAO and the World Health Organization (WHO) define energy requirement as "the amount of food energy needed to balance energy expenditure in order to maintain body size, body composition and a level of necessary and desirable physical activity consistent with long-term good health. This includes the energy needed for the optimal growth and development of children, for the deposition of tissues during pregnancy, and for the secretion of milk during lactation consistent with the good health of mother and child" (FAO 2001).

Energy for metabolic and physiological functions is derived from the chemical energy bound in food and its macronutrient constituents. As human energy and

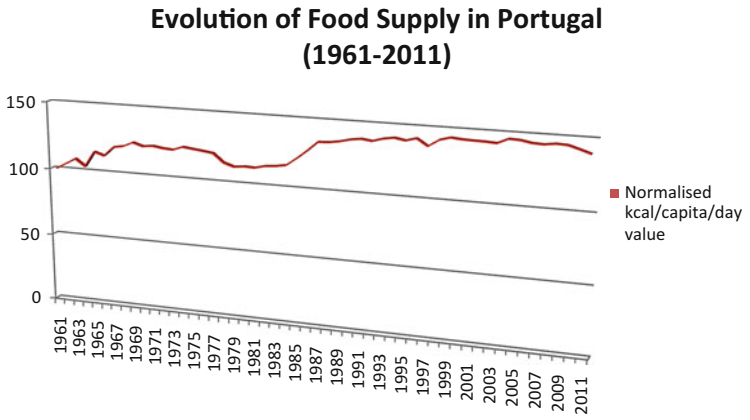


Fig. 2.1 Evolution of Food Supply in Portugal from 1961 to 2011. The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1961 value (2476.0 kcal/capita/day) is assumed to be 100. In accordance with FAO criteria, 'food supply' corresponds to 'average food available for consumption', which differs from actual average food intake, due to losses and waste at various levels of the food chain before reaching individual consumers

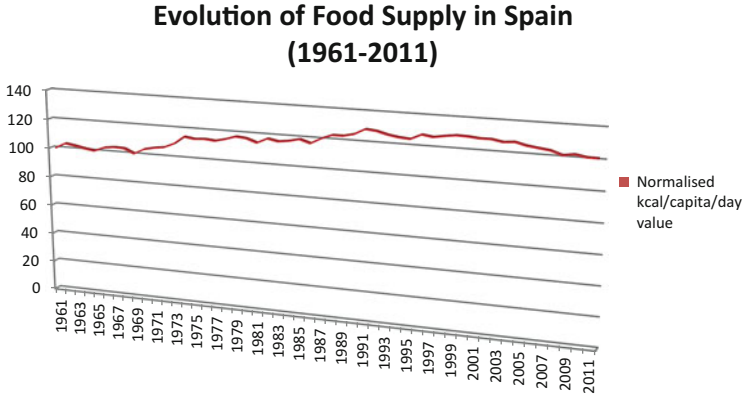


Fig. 2.2 Evolution of Food Supply in Spain from 1961 to 2011.The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1961 value (2632.0 kcal/capita/day) is assumed to be 100

nutritional requirements vary widely according to age, sex, physical activity, body size and composition and health/disease status, we have considered the theoretical recommendations for an 'average person' (that is, a healthy adult with moderate physical activity, irrespective of sex) of 1750–2750 kcal/day, in which the WHO reference value of 2000 kcal/day falls, to illustrate the extent to which national energy availability meets the population's requirements.

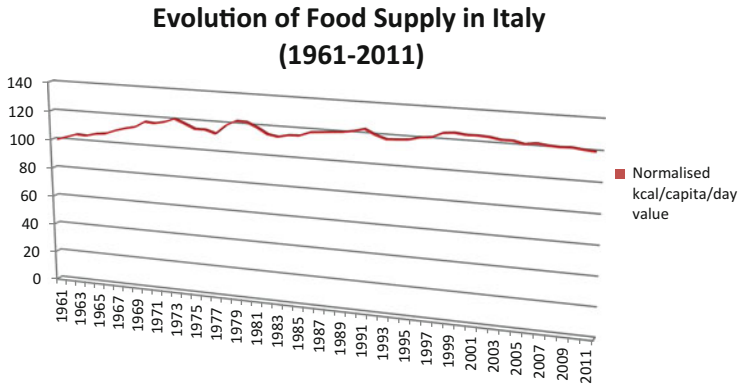


Fig. 2.3 Evolution of Food Supply in Italy from 1961 to 2011. The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1961 value (2955.0 kcal/capita/day) is assumed to be 100

Fig. 2.4 Evolution of Food Supply in Greece from 1961 to 2011.The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1961 value (2824.0 kcal/capita/day) is assumed to be 100

Figures 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7 indicate that, in 1961 and subsequent years, each average apparent food consumption or food availability at the national level was about 2000–2500 kcal/person/day, falling within the range of the referred ideal energy intake. The lowest value was registered for Morocco in 1961 (Fig. 2.6), followed by Cyprus (Fig. 2.7) and Portugal (Fig. 2.1). However, a marked increase in total energy available for consumption of approximately 450 kcal/capita/day was observed globally in subsequent years (WHO-ROEM 2012), and Mediterranean countries also followed this trend, reaching levels of 3500 kcal/capita/day and higher. More recently, a downward trend in the average total energy available has been registered in the region, except for Morocco and Cyprus (Figs. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7).

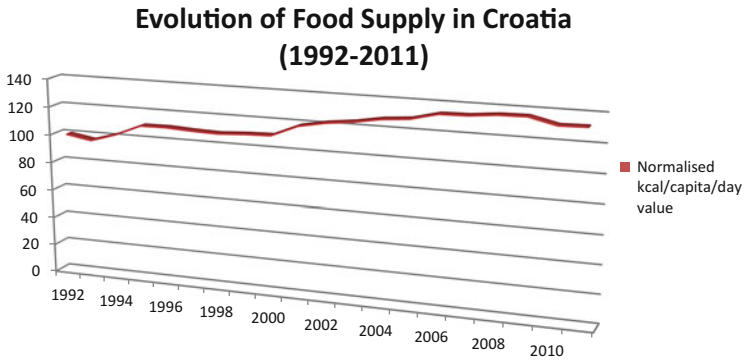


Fig. 2.5 Evolution of Food Supply in Croatia from 1992 to 2011. The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1992 value (2312.0 kcal/capita/day) is assumed to be 100

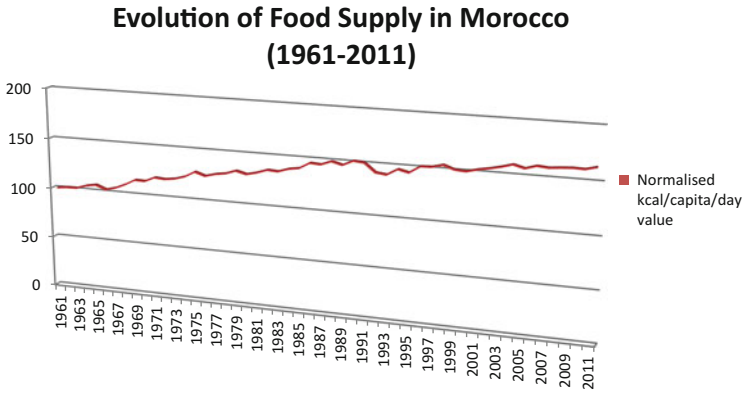


Fig. 2.6 Evolution of Food Supply in Morocco from 1961 to 2011. The graph shows the observed and normalised trend on the basis of FAO data (FAO 2015a) as kcal/capita/day values. The 1961 value (2047.0 kcal/capita/day) is assumed as 100

By the end of the Seven Countries Study, Keys and colleagues (1980) observed a westernization of food habits in the region, which has recently been confirmed by other authors (da Silva et al. 2009) in Mediterranean European countries. This involves an increased consumption of meat, milk, animal fats, vegetable oils (excluding olive oil) and sugars and a decreased consumption of cereals, legumes and wine and other alcoholic beverages (Vareiro et al. 2009). These aspects are discussed in more detail in Part II.