

OLIVE OIL

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Olive Oil

By

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Dedicated to
my wife Eleftheria

Preface

The history of the olive is as old as man himself. This volume begins in ancient times and progresses to modern scientific and technological viewpoints. The first chapter mainly covers the historical uses of olives and olive oils. The rest of the chapters discuss the scientific aspects relative to the botanical properties, the chemistry of the plant, as well as the technological and analytical aspects. Each topic is well-covered, and the editor and the authors display a deep knowledge of the science involved that derives from solid, daily experience with the subject.

Not only is this a complete and excellent volume from a scientific viewpoint, but it also espouses Kiritsakis' deep love of the olive plant, which I find symbolic of a love of humanity and its long journey, as the olive branch is now a symbol of good health as well as a symbol of peace.

Enzo Fedeli

Foreword

Many recent scientific publications emphasize the positive health effects of olive oil. The positive effects of olive oil consumption are reflected in the good health and life expectancy of the older generations of Cretans, who seem to have preserved their traditional dietary patterns for over 4000 years up until the last few decades. The beneficial effects of olive oil consumption within the framework of a healthy lifestyle appears to be the major reason for the low incidence of coronary heart disease mortality among the Cretans.

Although genetic engineering has succeeded in producing other vegetable oils with a similar fatty acids composition, the uniqueness of olive oil is unquestionable. Dr. Kiritsakis' book on olive oil provides an opportunity for researchers to have factual and detailed information on the history of olive oil production, its properties, composition, and biological effects at their fingertips. Dr. Kiritsakis' work is greatly needed, and will fill a vacuum in international literature. A publication on olive oil where specific attention is given to its effects on serum lipoprotein levels in relation to cardiovascular diseases and cancer prevention is of enormous significance within the field of preventive medicine.

It is an honor to introduce Dr. Kiritsakis' book which, I am sure, will be a valuable reference text for nutritionists, dieticians, physicians, and all related health and agricultural scientists.

Anthony Kafatos, M.D.

Notes

The olive tree has been cultivated for thousands of years around the Mediterranean Sea. The fruit and oil of this tree have contributed significantly to the diet of the Mediterranean people and is connected to the civilizations that flourished there. The olive branch symbolized friendship and peace among nations and the winners of the ancient Olympic games were crowned with branches of olive trees.

Olive oil has been used as a fuel and as a medicine, but modern technology and medicine have found replacements for these uses. Olive oil, however, is still a basic staple in the diet of the Mediterranean people and is appreciated internationally for its fragrant and delicate flavor. Recent findings indicate that olive oil may contribute to the prevention and control of cardiovascular or other diseases.

The author felt a special predilection for the study of olive oil early in his academic career. He is a native of Crete, a Greek island where the olive tree has been grown intensively since antiquity. Olive oil was the subject of his M.Sc and Ph.D research in the USA after earning a Greek B.S degree in Agronomy. He later worked in a Greek Olive and Subtropical Crops Experimental Station in Crete.

In this book olive oil is discussed in all its aspects: its biosynthesis and chemistry, the harvesting of the olive fruit, the extraction, processing, storage and packing of olive oil, as well as the quality control, deterioration, adulteration, analysis and marketing of olive oil. A special chapter is devoted to the nutritional qualities of olive oil.

I would like to thank the many people who have helped prepare my manuscript. First I thank my wife Eleftheria for her help in the original translation. I am really indebted to my teacher at Michigan State University and dear friend P. Markakis who reviewed the book, and made pertinent suggestions. His great assistance is really appreciated. My sincere appreciation is also extended to my major professor Dr. L.R. Dugan for making very useful suggestions for this book.

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Apostolos (Paul) Kiritsakis
Thessaloniki, Greece
March, 1991

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Contents

Preface.....	i
Chapter 1 History of the Olive Tree	1
Chapter 2 Botanical Characteristics of the Olive Tree	9
Chapter 3 Olive Fruit-Olive Oil Formation	12
Chapter 4 Chemistry of Olive Oil	25
Chapter 5 Harvest and Storage of Olive Fruits	56
Chapter 6 Extraction of Olive Oil	61
Chapter 7 Olive Oil Extraction Systems	71
Chapter 8 Subproducts of the Olive Oil Processing	80
Chapter 9 Chemical and Other Treatments of Olive Oil	86
Chapter 10 Olive Oil Storage	91
Chapter 11 Packing of Olive Oil	96
Chapter 12 Deterioration of Olive Oil	104
Chapter 13 Factors Affecting Olive Oil Quality	128
Chapter 14 International Olive Oil Council-Olive Oil Quality	132
Chapter 15 Olive Oil Adulteration	147
Chapter 16 Determinations on Olive Oil-Adulteration Tests	151
Chapter 17 Biological Effects of Olive Oil on Human Health — <i>Anthony Kafatos and George Comas</i>	157
Epilogue Future Research Needs	182

Chapter 1

History of the Olive Tree

Olive trees are among the oldest known cultivated trees in the world. The botanical progenitor of the olive tree is not accurately known, but it is thought to be the Oleaster *Olea sylvestris* which is still grown wild in North Africa, Portugal, southern France, Italy and by the Black and Caspian Seas (1). According to another theory, the olive tree is a descendant of *Olea chrysophylla*, which grew in Ethiopia, Kenya, Uganda and neighboring areas. These two species probably originated from another which covered much of the Sahara Desert prior to the glacier age (1).

Unquestionably, the cultivation of the olive tree commenced before the written word was invented (2). De Candolle, along with other historians, considers Syria and Asia Minor, where wild olive trees grow in abundance on mountainsides, as the origins of the cultivated species. Wild olive trees, however, grown in North Africa, Spain and Greece render uncertain the exact origin of the olive tree.

Others believe that the olive tree originated from Africa (Ethiopia, Egypt). This is where olive trees were first cultivated systematically, and from where they spread to Cyprus, Morocco, Algeria, Tunisia and elsewhere by the Phoenicians. The historian Theophrastos reported that the olive tree grew in southern Italy, Syria, Arabia, Egypt and elsewhere. The olive tree was cultivated in Egypt thousands of years ago. It was around 2000 B.C. though that olive orchards disappeared, either because they were destroyed for some unknown reason or because the interest of the people turned to other crops. Perhaps at that time, olive trees were brought to the southern coast of Crete. Others believe that the olive tree was originally spread in the Greek islands and in the mainland of Greece from North Syria. Genetic and archaeological studies indicate that the original center of olive cultivation was Palestine, Lebanon, Syria, Cyprus and Crete (3,4).

Olive tree cultivation spread from Greece or North Africa to Italy and to other Mediterranean countries around 600 B.C. (5,3). The olive tree was probably introduced to Spain by the Greeks, the Romans and the Arabs. That is indicated by the use in Spain of both Greco-roman and Arabic words associated with olives. The olive fruit, for instance, is called "aceituna" and the olive oil "aceite" which are Arabic words, while the tree is called "olive" which is Latin from the Greek "elea."

The olive tree was widely cultivated in southern Europe and this is why it is called *Olea europea*. About 98% of the existing olive trees today are grown around the Mediterranean Sea. The Jewish people knew about the olive tree thousands of years ago. In the Hebrew culture, the olive tree symbolizes peace and happiness (5). The Romans considered those who used animal fats instead of olive oil in their diet as barbarians. Rome extended olive cultivation to the entire empire under its occupation (6).

The olive culture played an enormous role in the early civilizations of Egypt and Greece (5). Athens was named in honor of the goddess Athena who brought the olive tree to the city. Plato's Olive Tree on Holly street (Iera odos) in Athens still exists. Solon had passed special laws for the olive tree. It is believed that the god of farming and animal raising, Aristeos, invented the cultivation of the olive tree and the olive oil mill.

The olive tree is of great historical importance. It played an important role in areas such as diet; religion; and the decoration of pottery, of walls, and of gold pieces of art. It also constituted the symbol for peace, wisdom and victory. The crowning wreaths for the winners of the Olympic games were made of a wild olive tree branch (Kotinos).

The therapeutic properties of olive oil were known to Hippocrates, the father of medicine. The consumption of a spoonful of oil was common practice for many people, and still is for some despite the advancement of pharmacology.

Pictures found in the palace of Knossos in Crete indicate that people consumed olives, and used olive oil for cooking and for fuel in lamps. Archeologists believe that the wealth of the Minoic Kingdom was related to the successful trade of Cretan olive oil (1,3). Huge clay containers were used for the storage of olive oil can be found even today in ancient Knossos and Phestos and in other places.

Spreading of the Olive Tree in the Western Hemisphere

The olive tree was not native to the New World. Spanish and Portugal settlers as well as Franciscan missionaries brought the olive tree to California and to other subtropical areas of the Western Hemisphere (7).

Several cultivars were brought to California from the Mediterranean countries between the years 1850 to 1900, and it was clear already by 1875 that olive tree cultivation would be an asset both for the farmers and the economy of California. In that year there were about 11,500

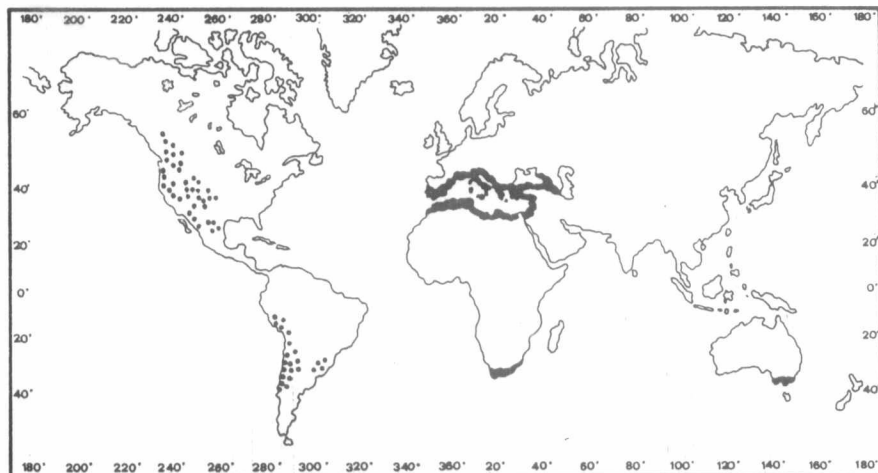


Fig. 1.1. Regions where the olive tree is cultivated.

olive trees; by 1910 their number grew to one million trees. People in California realized early that table olives gave more profit than olive oil. Thus many trees were grafted with table cultivars (8). It is the author's opinion that olive oil production should be increased in the United

TABLE 1.1

Geographical distribution of olive oil production.*

Europe 84%	Asia 5.5%	Africa 8.5%	Americas 2%
Spain	Turkey	Tunisia	Argentina
Italy	Syria	Algeria	U.S.A.
Greece	Lebanon	Morocco	Mexico
Portugal	Israel	Libya	Uruguay
France	Iraq	N. Africa	Peru
Soviet Union	Iran		
Yugoslavia	Japan		

*Reprinted with permission from Fedeli, E., *Lipids of Olives*. Prog. Chem. Fats and other Lipids 15:57 (1977).

States, since the Americans have started to realize the significance of this oil in their diet (See Chapter 17).

Italian immigrants brought the olive tree to Australia. The first trees were planted in Sidney around 1805. Efforts made to establish an olive industry in Australia, part of which is well suited to the cultivation of this tree, were not met with enthusiasm. As a result, most of the oil consumed was imported from Europe before World War II (9).

TABLE 1.2

World production and consumption of olive oil and table olives (Average 1978-1983 thousand metric tons).

Country (millions)	Number of olive trees	Olive oil		Table olives	
		Production	Consumption	Production	Consumption
Algeria	20.2	11.7	11.6	6.2	5.3
Argentina	5.0	11.1	2.0	31.0	11.9
Chile	0.8	0.2	0.3	3.2	3.3
Cyprus	2.6	1.7	1.9	3.7	4.0
Egypt	1.1	0.1	0.6	6.9	9.6
France	6.0	1.6	25.9	2.0	26.8
Greece	117.6	259.3	197.8	71.2	22.1
Israel	1.5	2.9	2.5	11.3	9.4
Italy	181.8	550.2	593.7	71.5	95.0
Jordan	2.7	8.2	9.9	7.8	8.0
Lebanon	6.0	5.2	6.9	5.6	6.0
Libya	8.0	7.1	47.8	1.7	6.6
Mexico	0.5	1.2	1.2	8.9	8.9
Morocco	30.0	23.3	21.8	48.4	16.0
Peru	0.6	0.1	0.2	14.5	14.5
Portugal	50.0	43.9	38.5	20.4	17.7
Spain	188.7	446.7	348.0	168.0	77.4
Syria	26.5	49.7	47.7	32.6	33.9
Tunisia	56.0	96.7	45.1	8.5	7.9
Turkey	82.0	111.7	88.5	123.5	117.8
Unit. States	2.2	0.8	27.0	68.1	108.0
Yugoslavia	4.5	3.0	4.0	0.5	1.5
Rest of world	10.7	4.1	58.4	11.0	96.9
TOTAL World	805.0	1,640.5	1,584.0	726.5	708.5

TABLE 1.3

Production of olive oil in EEC countries for the "olive year" 1987/88 (Thousand metric tons).

Country	Production
Spain	770.0
Italy	742.5
Greece	321.7
Portugal	38.0
France	4.0
TOTAL	1,876.2

TABLE 1.4

World olive oil production for the year 1981-90 (Thousand metric tons)*.

Years	Production
1981/82	1,583
1982/83	2,160
1983/84	1,444
1984/85	1,580
1985/86	1,480
1986/87	1,540
1987/88	1,710
1988/89	1,550
1989/90	1,850

*U.S. Department of Agriculture. Foreign agricultural service oilseeds and products (11).

A real effort for the development of olive cultivation in South Africa started in 1925 although the first olive plants were brought to the Cape in 1661. Recently, there has been significant interest for developing olive production in China, India, and other countries. Figure 1.1 shows where olive trees are cultivated today, all over the world.

World Production and Consumption

There are about 805 million olive trees in the world, covering approximately 24 million acres. Almost 98% of these trees are growing in the

Mediterranean area. The annual world production of olive fruit is about 9.4 million metric tons (MT). Approximately 720,000 MT of this production are consumed as table olives, and the remaining 8,680,000 MT are used for the extraction of olive oil. Nearly 1.6 million MT of olive oil are produced globally, plus 160,000 MT of olive pomace oil. About 260,000 MT of olive oil and 200,000 MT of table olives are traded in international markets.

The aggregate value of olive products is estimated to be 2.8 billion U.S. dollars- 2.5 billion represent the value of olive oil, and 0.3 billion the value of table olives. Olive products account for almost 25% of the farming income in the Mediterranean basin as a whole. The geographical distribution of olive oil production is shown in Table 1.1.

The production and consumption of olive oil and table olives in most of the olive-cultivating countries are shown in Table 1.2.

Table 1.3 gives the total olive oil production in European Economic Community Countries (EEC). Table 1.4 summarizes the total world olive oil production. The total world production of olive oil in comparison to other oils is shown in Table 1.5.

California produces 99% of the olives grown in the United States. Arizona is the only other state with a commercial production of olives. Most of the American olive crop is used for canning. The small amount of olive oil produced in California supplies less than 3% of the olive oil

TABLE 1.5

World production of edible oils (Thousand metric tons).*

Oils	1982/83	1983/84	1984/85	1985/86
Olive	2,160	1,444	1,580	1,480
Soya bean	13,616	13,160	13,330	13,640
Palm	6,006	5,589	7,040	8,290
Sunflower	5,809	5,699	6,080	6,380
Rapeseed	5,365	5,104	5,630	6,250
Cottonseed	3,346	3,364	3,870	3,430
Peanut	3,173	3,324	3,100	3,150
Cocoa butter	2,669	2,483	2,690	3,330
Palm kernel	731	769	950	1,130
Linseed	689	697	690	660
Fish	1,300	1,196	1,280	1,330

*U.S. Department of Agriculture. Foreign agricultural service oilseeds and products (11).

consumed in the United States, the rest is imported mostly from Spain and Italy. Major importing olive oil countries are: Australia, Brazil, Canada, France, Japan, Libya, Saudi Arabia, Switzerland, Turkey, United Kingdom, United States and Russia. Most of the world supply of olive oil originates from the Mediterranean countries. Of the 1600 thousand metric tons (MT) of olive oil produced globally in 1977, about 600 MT were produced in Italy, 360 MT in Spain, and 260 MT in Greece. Smaller quantities came from Tunisia, Turkey, Portugal, Morocco, Libya, and other countries near the Mediterranean Sea as well as from Argentina and California.

Olive oil is an important commodity in the daily diet of the Mediterranean people. The Greeks have the highest per capita consumption, 20.8 kg yearly, although it varies considerably among locations within Greece. The Spanish consumption is 10.0 kg/person/year followed by the Italian consumption at 8.1 kg/person/year (12,13). The consumption of olive oil in the United States has been increased considerably the last years.

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