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Chapter

Nutritional Values and Therapeutical Effects of Mediterranean Herbs, Spices, and Medicinal Plants

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Abstract

This chapter highlights the traditional use of Mediterranean edible plants, frequently used as herbs and spices in Mediterranean cuisine, and medicinal plants, used as natural therapeutics among the people in the Mediterranean region. The high phytonutrient content and diversity of these edible and nonedible wild plants in the Mediterranean are emphasized and their folk use is reviewed. The herbs, spices, and medicinal plants are vital constituents of the Mediterranean dietary pattern and lifestyle, known as the Mediterranean diet (MD). They significantly contribute to high antioxidant and anti-inflammatory character of the diet and its health and well-being benefits.

Keywords: herbs, spices, medicinal plants, bioactive compounds, Mediterranean diet

1. Introduction

In the 70s and 80s of the last century, the western world embraced low-fat, energy-dense, and calorie-counting diets; however, obesity, metabolic syndrome, and other noncommunicable diseases (NCDs) were on rise. Strong scientific evidence has linked the disorders related to metabolic syndrome and cardiovascular diseases, as well as the risks for many types of cancer and other diseases, to unhealthy diets and lifestyles besides genetics and other factors [1, 2]. To address the question if the most pressing diseases of modern society could be overcome by adopting traditional diets, many researchers studied the nutritive attributes and the health benefits of traditional diets and found that using raw (or less-processed) nutrient-dense food choices, like those consumed in the traditional diets, could improve the human health and well-being. In other words, the research proved that it is possible to live as Hippocrates said many years ago, “*Let food be thy medicine and medicine be thy food*” [3–6].

Mediterranean diet (MD) is one of the traditional diets that has attracted the attention of the scientific and medical community worldwide. MD is a nutrient-packed, mainly plant-based dietary pattern, emphasizing consumption of minimally-processed seasonal fruits and vegetables, whole grains, nuts, legumes, and seeds,

followed by moderate consumption of fish, poultry, fermented dairy products, and extra virgin olive oil (EVOO) as the main source of healthy fats, while the consumption of processed red meat products and refined sugars is limited. In addition, plenty of water, fruit juices, herb teas, and soups are also frequently consumed, and a moderate amount of red wine is usually taken with the meals.

People adhering to MD have been associated with a reduced risk of developing chronic diseases, including cancer, metabolic syndrome (obesity), depression, and cardiovascular and neurodegenerative diseases, as well as better cognitive health and increased longevity [7–9]. MD is also one of the most sustainable diets in the world and easy to follow outside the Mediterranean region. MD, if adopted widely, could reduce the high carbon footprint due to the current production of processed food and foods of animal origin, could lead to zero hunger and could lower the burden of noncommunicable and other “modern” diseases [10, 11].

When MD was originally promoted in the form of the Mediterranean diet pyramid, the herbs and the spices, often consumed within this dietary pattern, did not get their fair share. Years later, with the new proposed Mediterranean diet pyramids, herbs and spices were included and recognized to play an important role in Mediterranean cuisine and lifestyle. Examples of a diet pyramid and a lifestyle pyramid along with the MD health benefits are given in **Figure 1**. As reported before [8], the socializing aspect of MD, that is, the set of lifestyle habits and behaviors of the people in the Mediterranean, such as preparation and consumption of food together with family and friends, daily physical and leisure activities, festivities, the conviviality (the sense of being a part of the community), and adequate rests, are distinct features of the Mediterranean way of living, and are responsible for the health benefits. Furthermore, the regions around the Mediterranean sea are characterized by high biodiversity of plants, which have a long tradition of being used as herbs and spices in traditional Mediterranean cuisines, but also in folk medicine to treat different ailments and injuries. Due to the unique region’s climate and geography, such as high mountains and coastal areas, some of the herbs, spices, and medicinal plants are indigenous, and some are even endemic, while some of them have been introduced in the region by the people migration, by trade activities and/or by the region’s occupation by other nations.

In this chapter, Mediterranean herbs, spices, and medicinal plants will be presented with an emphasis on their diversity and richness with bioactive components. In particular, the objectives of this study are as follows: to highlight the knowledge about the traditional Mediterranean edible and medicinal plants, often used as herbs, spices, and remedies for different ailments; to contribute toward the preservation of this traditional knowledge; to inspire the readers to search for their roots, heritage, and folk wisdom; and to encourage those involved in botanical and medical research to look closely in specific Mediterranean plants, which might help in the development of natural-based treatments for various injuries and diseases.

2. Mediterranean herbs and spices

Herbs and spices have been used for both, culinary and medicinal purposes, since the beginning of human history. They have been used mainly for food and beverage flavoring and coloring, but also for food preservation. The wide use of some herbs and spices as remedies to treat different ailments has been most likely due to their high



Figure 1.
MD inspired® food and lifestyle pyramids with the associated health benefits.

content of various bioactive compounds, such as phenylpropanoids, terpenes, isoflavones, flavonoids, and anthocyanins [2, 12–14].

Herbs usually refer to the leafy parts of the plant, while spices are derived from other parts of the plants, viz. roots, stems, bulbs, barks, or seeds. Herbs and spices may derive from the same plant; in any case, both represent highly-concentrated sources of phytochemicals. The traditional MD emphasizes a high consumption of wild greens, spices, and herbs, which due to their high content of polyphenols and other bioactive, are responsible for the high level of dietary antioxidants consumed by the people adhering to the MD. Some herbs and spices are being categorized as functional foods (or nutraceuticals) yielding health properties beyond basic nutrition, like reduction of the risks related to cardiovascular disease (CVD), cancer, obesity, diabetes, Alzheimer's disease, etc. [15, 16]. Moreover, the borderline between herbs, spices, and remedies, sometimes, is not obvious; some of the plants, like the *Allium* family (viz. garlic, onion, leek, shallots, and chives) can be used in all these categories, as a whole plant or part of it. These bioactive components in the herbs and spices used in the MD are also contributing to the two attributes of MD that this diet is known for—its antioxidant and anti-inflammatory character.

The herbs and spices are also responsible for the unique character, flavorful taste, and excellent aroma of the traditional Mediterranean dishes in addition to the raw ingredients used and the preparation methods utilizing minimum cooking, in mainly, extra-virgin olive oil. Furthermore, the generous use of herbs and spices in MD, also replaces part of the salt, and thus, reduces the sodium intake in those adhering to the MD. In addition, the plethora of flavors and tastes of MD dishes contribute to the feeling of satiety (i.e., sense of fullness), and thus, yield less incidents of over-eating.

In the text below, the edible plants, such as herbs and spices, often used in traditional Mediterranean cuisine and lifestyle are described. A nonexclusive list of the most used herbs, spices, and medicinal plants in the Mediterranean region is given below: *garlic, onion, leek, mint, parsley, oregano, basil, rosemary, thyme, dill, fennel, marjoram, rosemary, lavender, bay (laurel) leaf, sage, cumin, paprika, hot (chili) pepper, coriander, marjoram, purslane, nettle, cinnamon, clove, ginger, saffron, chamomile, linden, dandelion, calendula, lavender, St. John's Wort, echinacea, chicory, milk thistle, red clove, and others*. Some of them are presented in **Figure 2**.

Due to their importance, *Allium* vegetables will be described in more detail. *Allium* vegetables are frequently used in Mediterranean cuisine as vegetables, but also as herbs and flavoring spices. The genus includes approx. 500 species among which are onions (*A. cepa*), garlic (*A. sativum*), leeks (*A. porrum*), shallots (*A. ascalonicum*), and chives (*A. schoenoprasum*). Garlic and onions are accounted among the oldest cultivated plants in the world; they both are also the key ingredients in the Mediterranean dietary pattern yielding the specific taste and aroma of many traditional savory dishes. From ancient times, garlic and onions have also been used for preparation of numerous remedies in folk medicine [16–18]. Shallots, which are closely related to onions, are characterized by their less pungent onion flavor, while scallions are also referred as green onions. The chives are distinguished by their edible green parts with mild onion flavor, while the leeks have edible green leaf sheaths and white flesh with a characteristic flavor.

Allium vegetables are rich in various bioactive constituents, including organosulfur compounds, flavonoids, saponins, and many other polyphenol compounds, with a spectrum of biological activities, including antimicrobial, antihypertensive, antidiabetic, and anticarcinogenic effects, among others. A summary of the nutrients, vitamins, and minerals in the *Allium* vegetables is given in **Tables 1–3**



Figure 2.
 Herbs, spices, and medicinal plants are often used in the Mediterranean region.

	Garlic	Onions	Leeks	Chives	Shallots
Total lipids [g]	0.5	0.1	0.3	0.7	0.1
Total sugars [g]	1.0	4.2	3.9	1.9	7.9
Proteins [g]	6.4	1.1	1.5	3.3	2.5
Dietary fibers [g]	2.1	1.7	1.8	2.5	3.2

Table 1.
Nutritional value of several allium genus per 100 g [19].

	Garlic	Onions	Leeks	Chives	Shallots
Calcium [mg]	181.0	23.0	59.0	92.0	37.0
Magnesium [mg]	25.0	10.0	28.0	42.0	21.0
Potassium [mg]	401	146	180	296	334
Zinc [mg]	1.2	0.2	0.1	0.6	0.4
Phosphorus [mg]	153	29	35	58	60
Iron [mg]	1.7	0.2	2.1	1.6	1.2

Table 2.
Minerals in several allium genus per 100 g [19].

	Garlic	Onions	Leeks	Chives	Shallots
Ascorbic acid [mg]	31.0	7.0	12.0	58.1	8.0
Vitamin B6 [mg]	1.235	0.12	0.233	0.138	0.345
Folate [μ g]	3.0	19.0	64.0	105.0	34.0
Riboflavin [mg]	0.11	0.027	0.03	0.115	0.02
Niacin [mg]	0.70	0.116	0.400	0.647	0.200
Vitamin A [IU]	9.0	2.0	1.667	4.353	4.0
Vitamin E [mg]	0.1	0.0	0.9	0.2	0.0
Vitamin K [μ g]	1.7	0.4	47.0	217.7	0.8 g

Table 3.
Vitamins in several allium genus per 100 g [19].

[18–22]. Low in fats and sugars, *Alliums* are rich sources of minerals, such as calcium, potassium, phosphorous, magnesium, and vitamins, for example, vitamin C and some of the *Alliums* are rich in vitamins B, K, and A.

The beneficial properties of the *Allium* genus are mainly attributed to the presence of a number of *organosulfur compounds*, such as alliin, allicin, dimethyl disulfide, methyl propenyl disulfide, propyl propenyl disulfide, dimethyl trisulfide, methyl propyl trisulfide, methyl propenyl trisulfide, S-methyl cysteine sulfoxide, S-propyl cysteine sulfoxide, S-propenyl cysteine sulfoxide, and N- γ (-glutamyl)-S-(E-1-propenyl) cysteine. Moreover, the characteristic flavors and odors of *Allium* vegetables arise from these sulfur-containing compounds [23, 24]. Several of the organosulfur compounds found in the *Alliums* are given in **Table 4**. Among numerous benefits, *Alliums* could affect many biological processes, which modify and reduce cancer risks [25–29]. In fact, it has been found that *Alliums* have effects on each stage

Compound	Chemical structure
Alliin	
Allicin	
Diallyl sulfide	
Diallyl disulfide	
Diallyl trisulfide	
Allyl methyl sulfide	
Ajoene	

Table 4.
 Organosulfur compounds in allium vegetables.

of carcinogenesis. As for many other *Alliums*' benefits, the anticancerogenic effects have been attributed mainly to the sulfur-containing, which besides the antimicrobial activities, contribute to reduced bioactivation of carcinogens. Among the protection against cancers and tumors, the most reported benefit of *Alliums* consumption has been related to gastric cancer. This is most likely because *Alliums* have shown inhibitory effects on the growth of *Helicobacter pylori*; *H. pylori* infection has been identified as one of the risk factors for gastric cancer [28, 30, 31]. The protective effects of *Allium* plants have been also reported against prostate and breast cancers [29]. The *Alliums*' organosulfur components have been also shown to inhibit several proinflammatory enzymes, such as cyclooxygenase and lipoxygenase [28].

Garlic (*Allium sativum* L.) is a bulbous plant, which is commonly used as a spice to add flavor not only in the Mediterranean but also in many other traditional cuisines around the globe. Like the other *Allium* plants, garlic is rich in organosulfur and polyphenolic compounds, both categories of compounds resulting in its strong antioxidant, anti-inflammatory, anticancerogenic, and other beneficial activities. The major garlic thiosulfinate produced is allicin (thio-2-propene-1-sulfenic acid S-allyl ester). Allicin and its oil-soluble metabolites are largely responsible for the garlic's odor. However, allicin is unstable and breaks down further to ajoene, vinylthiols, and sulfides, including diallyl sulfide (DAS), diallyl disulfide (DADS), and diallyl trisulfide. Various sulfur compounds, including allicin, DAS, DADS, and ajoene derivatives (**Table 4**) also contribute to garlic's antimicrobial properties. Allicin is considered as a natural antibiotic, which does not appear to create resistant bacteria strains, and in combination with the other sulfur compounds in garlic, has been shown to be deadly for many viruses and bacteria [25–38]. Antifungal properties of garlic have been reported, too [17]. Diallyl disulfide, diallyl trisulfide, S-allyl-mercapto cysteine, S-allyl-L-cysteine, and others have been shown to exert potent anti-inflammatory, antifibrotic, antioxidative, and antimetastatic effects [28]. Furthermore, garlic has been recommended as beneficial for patients with dyslipidemia and diabetes. In traditional Mediterranean medicine, garlic has been used for boosting the immune system. A remedy prepared with honey and garlic cloves has been used for respiratory infections, for example, to relieve bronchitis, influenza, and lung

infections, while a remedy prepared with garlic and milk is being used to treat fever and croup [24, 29]. Garlic has been also used to fight fungal (yeast) infections, such as candida.

Aged garlic extract and fresh garlic extract have been compared and found that both have anticancer effects. Namely, aged garlic has cytotoxic effects on cancer cells by causing oxidative stress in the mitochondria, while fresh garlic extract suppresses cancer cell proliferation. Aged garlic extract had a blood pressure-lowering effect, and thus, might be a safe adjunct treatment in addition to conventional antihypertensive therapy. Garlic significantly lowers systolic blood pressure and diastolic blood pressure and could act as an anticoagulant. It also reduces the level of C-reactive protein, and thus, has anti-inflammatory activity [28, 37].

Onion (*Allium cepa* L.) has been consumed in traditional Mediterranean cuisine as both, a vegetable and a flavoring spice, due to its pronounced and characteristic flavor. The bulbs and leaves of various types of onions have a variety of flavors and textures responsible for the palatability of traditional Mediterranean dishes. Onion consumption varies in the region, but onions are typically consumed in larger quantities than garlic, chives, shallots, or leeks. Onion consumption has increased significantly over the years and might be among the most consumed vegetables. Onions are rich in flavonoids and organosulfur compounds. Onion bulbs are among the richest sources of dietary flavonoids and might be the largest contributor to the overall intake of flavonoids in the diet. Two flavonoid subgroups are found in onions, anthocyanins, which impart a red/purple color to some varieties, and flavanols (e.g., quercetin and its derivatives) responsible for the yellow and brown skins of other onion varieties. The organosulfur compounds are the flavor precursors, which, when cleaved by the enzyme alliinase, generate the characteristic odor and taste of the onion. The downstream products are a complex mixture of compounds, which include thiosulfinates, thiosulfonates, mono-, di-, and tri-sulfides. These compounds found in onions have been reported to have a range of health benefits, including anticarcinogenic properties, cardioprotective, antiplatelet, and antithrombotic activities, as well as anti-asthmatic and antibiotic effects [17, 39–49]. Onions have also been used in traditional medicine to treat different ailments, such as helping the body to release toxins, and as a remedy for cold and flu. Besides being an expectorant, it is also used as a diuretic and can facilitate muscle relaxation and improve blood circulation.

Leek (*Allium ampeloprasum* L. var. *porrum* or *Allium porrum* L.) is known for its high nutritional value, but also for its wide spectrum of biological activities, primarily a high antioxidant content and specific taste. Leeks show a wide spectrum of biological activities, among which are antimicrobial, cardio-protective, hypocholesterolemic, hypoglycemic, and anticancer activities. The anti-inflammatory, gastroprotective, and cytotoxic activities of organosulfate compounds have been well documented for leek. In addition, antimicrobial activity has been reported; in fact, leeks have been used to treat wounds and respiratory diseases [23]. The most important biologically-active compounds in the leek are polyphenols, glucosinolates, S-alkenyl-L-cysteine sulfoxides, and pectic polysaccharides, each showing immune-boosting activity. The polyphenol content in some leek types is comparable with the shallot and significantly exceeds that of garlic, chive, and onion. Kaempferol is the main flavonoid aglycone in the leek. Polyphenols along with vitamin C significantly affect plant antioxidant activity. The nutritional value of leek is also correlated with the high content of potassium and iron [49, 50]. Leek consumption is known to improve liver and gastrointestinal tract functioning, quicken metabolic processes, reduce blood pressure,

protect against anemia, enhance brain activity, and inhibit platelet aggregation, but is also useful in rheumatism treatment. Moreover, consumption of leek reportedly reduces the risk of prostate, colon, stomach, and breast cancers. Antimicrobial effects of leek have been reported for both, against gram-positive (e.g., *Streptococcus pneumoniae* and *Staphylococcus aureus*) and gram-negative bacteria (e.g., *Escherichia coli* and *Proteus vulgaris*); antifungal activity has been reported, too [49, 51]. Epidemiological studies have linked the reduction of the risk of prostate, colorectal, stomach, and breast cancer to leek consumption. In traditional medicine, leek has been used to ease the sting of insect bites, as a diuretic and a stimulant, remedy for respiratory problems, such as sore throat and cough, while warm juices of its leaves and bulb have been used for earaches [49–51].

Basil (*Ocimum basilicum* L.) is known as a royal herb, derived from “basileus” (meaning “king” in Greek), and is one of the most widely used herbs in Mediterranean cuisine. Extract from basil contains rosmarinic acid and catechin, which could protect against metabolic syndrome, anemia, osteoporosis, vitamin A, and iron deficiency. The antidiabetic effects of basil extract are most likely due in part to the rosmarinic acid content since rosmarinic acid has been found to inhibit α -glucosidase, α -amylase, and aldose reductase *in vitro*. Advanced glycation end products (AGEs) are usually a consequence of oxidative stress. It is known that polyphenols are potent antioxidants, thus, the anti-AGE effects of basil are associated with its relatively high polyphenol content. In addition, basil is also strong anti-inflammatory and antimicrobial plant, and has also favorable effects on blood pressure [52–56].

Mint (*Mentha sp.*) belongs to the genus *Mentha* of the Lamiaceae family; *M. spicata* L., *M. pulegium* L., and *M. rotundifolia* L. are some of the species that belong to this family. In general, mint is used for the preparation of herbal teas and as a spice in the Mediterranean. Species of the genus *Mentha* contain a range of components, including cinnamic acids and aglycon, glycoside, and/or acylated flavonoids, particularly flavones and flavanones. Luteolin and its derivatives are the main flavones found in *Mentha*; however, phenolic acids, like caffeic acid and its derivatives, chlorogenic and rosmarinic acid, and salvianolic acids have also been found in *Mentha* plants. The most recognized properties of the mint are antioxidant, antimicrobial, antiviral, anti-inflammatory, neuroprotective, cardiovascular, and antitumor properties [17, 57].

Peppermint (*Mentha piperita* L.), a member of the *Mentha sp.* family has the strongest flavor when compared to other members of the mint family. Compounds found in peppermint leaves are fatty acids—linoleic, linolenic, and palmitic acid, then triterpenoids and steroids, and different pigments, such as xanthophylls, chlorophylls, and carotenes [57].

Coriander (*Coriandrum sativum* L.) leaves and seeds are the edible parts of this plant and are often used in Mediterranean cuisine. Coriander leaves (or cilantro) are usually used in bean dishes, stews, dips, and salsas. The most potent compounds in the coriander are essential oils, flavonoids (quercetin, kaempferol, and acacetin), phenolic acids (vanillic acid, p-coumaric acid, syringic acid, cis-ferulic acid, and trans-ferulic acid), and polyphenols. It is also rich in vitamins, such as vitamins C and K [23]. Coriander seed extract significantly reduces serum glucose and increased insulin secretion by pancreatic β -cells compared to diabetic controls. Oral administration of coriander seed extract also reduces total cholesterol and increased HDL in diabetic rats. Coriander seeds are also hypolipidemic—they could mitigate atherosclerosis development by reducing circulating cholesterol, cholesterol synthesis, and facilitating cholesterol excretion [58]. It is also reported for its antibacterial and antifungal properties [53].

Parsley (*Petroselinum crispum* (Mill)) leaves are often used to add flavor to sauces, soups, and savory dishes, but also as a garnish for traditional Mediterranean dishes. The extract from parsley is high in flavonoid apigenin. Parsley extract has been shown to reverse hyperglycemia and protein glycation associated with diabetes. The mechanism for the antidiabetic action of parsley extract may be via inhibiting absorption of glucose by α -glucosidase. In addition, parsley has anti-inflammatory potential and greater parsley consumption, which may be beneficial in the treatment of hypertension, iron deficiency, anemia, and osteoporosis [58–60].

Rosemary (*Rosmarinus officinalis* L.) belongs to the *Lamiaceae* family and is usually used to flavor meat dishes, soups, and stews in the Mediterranean region. The leaves are used to prepare herbal teas, or steeped in vinegar and/or oil are used to flavor sauces. Rosmarinic acid is one of the major components of rosemary; it is a phenolic compound having pronounced anti-inflammatory, hepatoprotective, and antihyperlipidemic properties [14, 16, 17, 61, 62]. Namely, rosemary possesses therapeutic properties, such as hepatoprotective, antifungal, antioxidant, and antibacterial [53]. It also protects against hypertension and can be hypolipidemic. In addition, rosemary extract shows both subacute and acute antidiabetic potential. Rosemary also exhibits NO-scavenging activity, it could be used in cases of low blood pressure, anemia, iron deficiency, and gallbladder problems [55, 58, 63–69].

Sage (*Salvia officinalis* L.) is used to flavor meat, stews, and sausages. In dry or fresh state, sage leaves are steeped in water to make herbal teas. Sage is rich in polyphenols, particularly rosmarinic acid, caffeic acid, α - and β -pinene, limonene, thymol, carvacrol, and others [14, 58]. Sage has strong antioxidant, antibacterial, and antiviral activities. The sage extract can reduce hyperglycemia associated with diabetes after acute or sub-acute treatment; it can also exhibit an antidiabetic effect [58]. In addition, anti-inflammatory activity and beneficial effects on the blood lipid profile are found for sage. Sage has been suggested for novel natural treatment for cure of many serious diseases, such as depression, dementia, obesity, lupus, heart disease, and cancer. In Mediterranean traditional medicine, it has been used for the treatment of flu, fever, colds, and digestive problems [14, 58, 63].

Thyme (*Thymus vulgaris* L.) is the most widely used plant from the *Thymus* genus as a culinary herb in many savory dishes and as a medicinal plant. Fresh thyme is high in rosmarinic acid, thymol, carvacrol, p-cymene, and luteolin. The health effects of thyme and its constituents, particularly thymol and carvacrol, include antioxidant, antimicrobial, anti-inflammatory, respiratory, and neurological effects [53]. Regarding inflammation, thyme extract was found to significantly inhibit metabolic activity, neutrophil adhesion, and superoxide production in a dose-dependent manner. Thyme extract can also be hypolipidemic, but also could help with anemia, iron deficiency, bronchitis, flu, etc. Traditional remedies utilizing thyme include alleviation of depression, epilepsy, and nightmares, as well as treatments of headaches and coughs [14, 53, 55, 66].

Oregano (*Origanum vulgare* L.) is usually used as dried in many dishes in the Mediterranean region, such as soups, meat and vegetable dishes, and pizza. Leaves and flowering tops of oregano are also used in preparation of tea drinks. It has a high content of polyphenols, among which rosmarinic acid is the most representative compound found in it. Oregano and oregano oil have strong antibacterial, antifungal, and antiviral properties [53]. Oregano extract exhibits a wide range of antidiabetic and hypolipidemic effects. It has been shown that oregano alleviates oxidative stress, decreases markers of inflammation *in vitro*, and helps with throat infections, coughs, and headaches [14, 54, 55, 58, 66].

Marjoram (*Origanum majorana* L.) leaves are commonly used to flavor Mediterranean dishes, but also for flavoring vinegar and oils. Phenolic acids found in this plant are trans-2-hydroxycinnamic acid, rosmarinic acid, and biflavone amentoflavone as its most prevalent flavonoid. The plant exhibits antioxidant, antidiabetic, and anti-inflammatory potential, which lowers fasting glucose and glycated hemoglobin, and improves oral glucose tolerance compared to the diabetic control. *In vitro*, marjoram extract prevents hemoglobin, albumin, and LDL glycation, but it may also protect against diabetic nephropathy [58, 70, 71].

Cayenne pepper (*Capsicum annum* L.) is found in a wide range of spiciness, which originates from the pepper's active ingredient, capsaicin. Capsaicin is an alkaloid that accounts for ~50–70% of the total capsaicinoids, dihydrocapsaicin accounts for 20–25%, while cryptoxanthin, which is a carotenoid, acts as a pigment and it gives the pepper its red color. In addition, cayenne pepper also contains nonpungent compounds called capsinoids (e.g., capsiate and dihydrocapsiate). Cayenne peppers exhibit antioxidant and anti-inflammatory effects, can exhibit control over blood glucose, and decrease the risk of CVD and cancers, but also are beneficial for gut health and management of satiety and weight. It is also known to possess protective activities against asthma, cancer, and diabetes. In addition, capsaicin has been also used to treat cancer; more recent findings revealed that it has an effect on promoting apoptosis and inhibiting tumor growth [17, 23, 72]. Cayenne pepper can also help with ulcers causing internal pain. Although people often associate spicy foods with stomach upset, but capsaicin aids in helping reduce ulcers by restricting the growth of an ulcer-causing bacteria (*H. pylori*), reducing excess stomach acid and increasing blood flow; the antimicrobial activity has been highlighted by its inhibitory effects against *H. pylori* and other bacteria and fungi.

Long pepper (*Piper longum* L.) is a spice, where the whole plant is used as it is and is known to yield many biologically-important compounds, such as piperine, piperlongumine, and piperinic acid. They are known for their benefits in the treatment of inflammation-mediated diseases (cancer, lupus, arthritis, and asthma) due to their ability to suppress pro-inflammatory cytokines (TNF- α and IL-6 induce the expression of anti-inflammatory cytokine IL-10). Paprika, a commonly used spice in the Mediterranean, is usually made from dried and ground red peppers from the *Capsicum annum* family, but also from the Longum group of peppers, which includes chili peppers [17].

Saffron (*Crocus sativus* L.) belongs to the Iridaceae family. The interest in saffron, that is, in the stigmas of the flower of *Crocus sativus*, is due to its content of many bioactive molecules with health-promoting properties, including crocin, crocetin, picrocrocin, and safranal. The spice saffron is actually made from the dried stigmas of the plant. The main use of saffron is in cooking, due to its ability to impart color, flavor, and aroma to variety of foods and beverages. Among the various therapeutic properties it possesses, the most notable are its antidepressant, anti-inflammatory, and antitumor effects. Among different compounds, safranal is the constituent primarily responsible for the aroma of saffron and exhibits antioxidant and gastroprotective effects. Saffron has been also found to help with improving mood, treatment of depression, reducing PMS symptoms and CVD risks, and weight management [17, 73–77]. The *Crocus sativus* L. plant contains various compounds belonging to different classes of secondary metabolites, such as carotenoids, monoterpenoids, flavonoids, and anthocyanins. Carotenoids are the most important components of saffron stigmas, responsible for the colorant features of this spice; they include both, fat-soluble carotenoids, such as lycopene, α - and β -carotene, zeaxanthin,

and water-soluble C20 apocarotenoid, crocetin, and its ester derivatives. Several minor components have been also isolated from stigmas and other plant parts, such as petals and corms; terpenoids are the most often components, while the crocusatins, present in stigmas and petals, show significant antityrosinase activity. A series of flavonoids, all glycosidic derivatives of kaempferol, have been characterized in the stigmas of saffron and together with picrocrocin are responsible for the bitter taste of saffron [78].

Purslane weed (*Portulaca oleracea* L.) is popular in many regions around the Mediterranean sea. Studies have confirmed that the plant is a rich source of phytochemicals, such as flavonoids, alkaloids, terpenoids, proteins, carbohydrates, vitamins (A, C, E, and B), carotenoids, and minerals (phosphorus, calcium, magnesium, and zinc). It is particularly very important due to the presence of a very high concentration of omega-3- fatty acids, especially α -linolenic acid, gamma-linolenic acid, and linoleic acid. Purslane is one of the richest source of omega-3 fatty acids, alpha-linolenic acid (ALA), and gamma-linolenic acid (LNA), among many green leafy vegetables. Omega-3 fatty acids are known to protect against cardiovascular disease, cancers, and other chronic diseases. Moreover, purslane has shown anti-inflammatory, antidiabetic, antitumor, hepatoprotective, anticancer, antioxidant, anti-insomnia, analgesic, gastroprotective, neuroprotective, wound healing, and anti-septic properties [79–81].

Bay leaf (*Laurus nobilis* L.) is often used in a variety of MD-style cooking and preservation processes of sweet and savory dishes. The extract of bay leaves contains minerals, vitamins, and essential oils, such as cineol, eugenol, chavicol, acetyl eugenol, methyl eugenol, and β -pinene, various flavonoids, such as quercetin and kaempferol, as well as various sesquiterpenes. Bay leaf exhibits a wide array of antioxidant, anti-inflammatory, antidiabetic, diuretic, and appetite-stimulating effects. Several *in vivo* studies support the hypolipidemic effect of the bay leaf, that is, lowering the plasma total cholesterol, triglycerides, and glucose [17, 58].

Dill (*Anethum graveolens* L.) is a spice used for seasoning traditional Mediterranean fish and vegetable dishes. Fresh dill has a high content of quercetin and isorhamnetin. The dill extract has antidiabetic potential, as well as can be hypolipidemic. It could also help with the issues of immune deficiency, kidney stones, osteoporosis, and vitamin A deficiency. Dill seeds have been used in the folk to treat insomnia, respiratory disorders, calm down allergies, and boost immunity [58].

Fennel (*Foeniculum vulgare* Mill.): bulbs, leaves, flowers, and seeds are all considered edible parts and used for preparation of many dishes consumed within the Mediterranean dietary pattern. Bulbs are usually used raw in salads, seeds are used for flavoring sausages and bread, while the leaves are cooked with fish, or used for preparation of herbal teas. The most prevalent flavonoid in polar extract of fennel leaves is quercetin. The potential health benefits of fennel have been reported to be antidiabetic, anti-inflammatory effects have been related to the consumption of fennel seed extract, and antihyperlipidemic have been associated with the fennel bulb. In particular, the fennel bulb extract has been reported to manage the total cholesterol, triglycerides, and LDL levels, as well as prevent lipid accumulation in the coronary artery and decrease the hepatic total cholesterol and triglycerides. It also possesses antimicrobial properties [53, 58].

Black pepper (*Piper nigrum* L.), commonly known as pepper, is considered to be the “king of spices,” because of its high trade share in the global market. Black pepper is principally used as a seasoning ingredient to enhance food flavor, as well as in food preserving. Black pepper contains a number of bioactive ingredients, such as essential

oils and the alkaloid piperine. Many studies on the biological properties of piperine have revealed its antioxidant, anticarcinogenic, anti-inflammatory, antiulcer, antithyroid, and antimicrobial effects with some potential to modulate immune responses [53]. Apart from its culinary uses, *P. nigrum* is also used as an insecticide [82–85].

Sesame seeds (*Sesamum indicum* L.) belong to the *Pedaliaceae* family and exhibit medicinal properties, such as anticancer, hepatoprotective, and antihypertensive. They contain various bioactive compounds, including lignans, tocopherol homologs, phytosterols, and others. Based on their medicinal and pharmacological properties, the most important lignans are sesamin, sesamol, sesamol, and sesamol, but also α -, γ -, and δ -tocopherols. In addition, sesame is an important source of phytosterols, phytates, polyunsaturated fatty acids, and bioactive peptides [17, 86–91].

Cumin seeds (*Cuminum cyminum* L.) are usually ground and used in herb rubs for meat dishes, as well as to flavor sauces, pickles, and bread. They are rich in phenolic acids, including chlorogenic acid and flavonoids, particularly apigenin. Cumin seeds have antidiabetic effects *in vivo*; cumin extract/ground cumin administered orally reduced blood glucose and glycosylated hemoglobin in diabetic rats. The seeds also reduced triglycerides and total cholesterol in plasma, liver, kidney, intestines, and pancreas of diabetic animals [17, 58, 92–95]. Cumin also exhibits antimicrobial properties [53].

Black seeds or black cumin (*Nigella sativa* L.) are totally unrelated to cumin seeds (*C. cyminum*); numerous preclinical and clinical trials have investigated their efficacy using the seed oil, essential oil, and its main constituent thymoquinone. Antidiabetic, anti-allergic, antimicrobial, immune-modulatory, anti-inflammatory, and antitumor effects have been observed for black cumin. It possesses gastroprotective, hepatoprotective, nephroprotective, and neuroprotective activities [96–98].

Clove (*Syzygium aromaticum* L.) is a spice that has been used as a food preservative and to add flavor to traditional dishes. The spice is derived from flower buds. It is rich in phenolic compounds, such as eugenol, eugenol acetate, and gallic acid, with great potential for pharmaceutical, cosmetic, food and agricultural applications [99]. Clove is also rich in manganese, potassium, vitamin K, and beta-carotene. Clove has been used mainly for oral health and treatment of gingivitis but also has antidiabetic, anti-inflammation, and antimicrobial activity [53, 100]. Clove also protects the stomach from ulcers and provides better liver function. Eugenol, the main component of clove oil, has strong antioxidant activity, as well [99, 101–104].

Cinnamon (*Cinnamomum* L.) spice is derived from the innermost bark of the cinnamon tree. Cinnamon's key components are essential oils and other derivatives, such as cinnamaldehyde, cinnamic acid and cinnamate, cinnamon oil, cinnamyl alcohol, cinnamyl acetate, eugenol, and water-soluble polyphenols, for example, catechin, epicatechin, procyanidin, quercetin, kaempferol, polyphenolic polymers, and various coumarins, which all contribute to its overall flavor and aroma [17, 100, 105]. In addition to its common culinary use as a condiment and flavoring spice, cinnamon is widely known for its antidiabetic and glucose-lowering effects [100]. Extracts of cinnamon and its major components (cinnamaldehyde and eugenol) have been shown to attack major respiratory and gastrointestinal tract pathogens *in vitro*. It has also beneficial effects on chronic salmonella infection. *In vitro* studies have suggested that cinnamon may have some bactericidal activity against *H. pylori*. Cinnamon has also shown anti-inflammatory, antimicrobial, and antioxidant effects; its polyphenol extracts suppressed inflammation processes through the regulation of anti- and proinflammatory gene expression *in vitro* [17, 53]. Studies showed that cinnamon supplementation significantly reduced blood triglycerides and total cholesterol

concentrations [106]. Consumption of cinnamon has been also associated with notable reductions in systolic and diastolic blood pressure, as well as showed blood glucose control and hepatoprotective and neuroprotective effects. Moreover, cinnamon may have protective effects against different metabolic syndrome aspects [17].

Ginger (*Zingiber officinale*) is a root or rhizome-based spice derived from the ginger plant, a member of the turmeric family (*Zingiberaceae*). It is a culinary additive—a hot and fragrant spice, as well as a folk medicine well-known for its use to treat nausea. Many components found in ginger have been found to have anti-inflammatory, antibacterial, antipyretic, antilipidemic, antitumorigenic, and antiangiogenic effects [53]. Ginger's flavor and aroma come from its volatile oils and nonvolatile pungent oleoresins. A variety of active components have been identified in the oleoresins of ginger, including zingerone, gingerols, and shogaols. Gingerols (e.g., 6-gingerol) are the major pungent components in the fresh ginger rhizome, while in dried ginger, the quantity of shogaols is significantly increased [17, 100, 105]. In general, ginger has been reported to have anti-inflammatory, antioxidant, antiplatelet, antihypertensive, and hypolipidemic effects. It could improve joint and muscle health, as well as has weight management potential and neuroprotective effects. Clinical trials have shown that ginger is safe and effective for decreasing nausea and vomiting during pregnancy or induced by chemotherapy. Ginger and its extracts (6-gingerols and 6-shogaol) exhibits substantial free-radical scavenging activities and inhibits the production of inflammatory mediators [17].

Anise (*Pimpinella anisum* L.) is a seed spice derived from a flowering plant belonging to the family Apiaceae, which is native to the eastern Mediterranean region. The distinctive licorice flavor and aroma from anise come from anethole—a phenylpropene derivative. Anethole exists in both a cis and a trans isomer. In Mediterranean countries, the popularity of alcoholic and nonalcoholic anise-flavored beverages has led to much greater consumption of trans-anethole. However, anethole is also used in medicines as an expectorant, an antitussive, and an antispasmodic for treating gastrointestinal tract illnesses; as a result, anise is found in a number of pharmaceutical products [105]. It has been used in traditional medicine due to its antimicrobial, anti-inflammatory, and antioxidant properties as well as antidiabetic [100].

3. Mediterranean medicinal plants

Mediterranean folk medicine has used local plants to treat different ailments since ancient times. A wide range of nonedible wild plants, characteristic in the Mediterranean region, has been used as natural remedies and therapeutics for curing fever, cold, and flu, for treatment of injuries, such as bruises, cuts, and insect bites, or simply to help with some neurological functions, such as reducing anxiety, stress, and improve sleep. Medicinal plants prepared in a form of extracts, tinctures, oil macerates, herbal infusions and teas, ointments, and balms are among the most used ones.

In recent decades, Mediterranean medicinal plants have been studied and some of them have been proven to be great alternatives and additions to the conventional drug treatments of severe diseases, such as cancer, without the side effects often associated with synthetic drugs. In the text below, a brief review of Mediterranean plants being used as natural therapeutics for treatment of different ailments is presented.

Dandelion (*Taraxacum officinale*) is a member of the *Asteraceae* family [107–110]. It is a nontoxic herb that has been exploited for its choleric, diuretic, anti-rheumatic,

and anti-inflammatory properties. It has also gained a lot of scientific attention due to its antioxidant activity and its beneficial effects against the development of obesity, cancer, and numerous CVD risk factors. Dandelion contains several phenylpropanoids yielding inflammation-modulating effects, inulin having immune-stimulatory functions, and terpenoids and polysaccharides having roles in immune regulation and platelet anti-aggregation activity, hepatoprotective effects, and antitumoral activity. Vitamins (A, B, C, D, and E), inositol, lecithin, minerals, and oligo-elements (calcium, potassium, sodium, magnesium, iron, silicon, copper, phosphorus, zinc, and manganese) are found in dandelion. Dandelion's bitterness is due to its sesquiterpene lactones (eudesmanolide and germacranolide types), which are unique to this plant and yield anti-inflammatory and anticancer functions. In particular, dandelion flowers are rich in phenolic compounds (phenolic acids and flavonoids), the roots contain terpenes (sesquiterpene lactones, triterpenes, and phytosterols), phenolic compounds (phenolic acids and coumarins), and carbohydrate (inulin), while the other aerial parts (leaves and stems) are rich in terpenes, phenolic compounds (phenolic acids, flavonoids, and coumarins) [110]. In addition to its uses in traditional medicine, dandelion has been used as a vegetable in preparation of fresh salads alone or in combination with other plants, such as lettuce, shallots, and chives. A comparison of its nutritional composition with similar vegetables, such as lettuce and spinach, shows that dandelion has a higher content of dietary fiber and proteins, as well as a variety of amino acids, vitamins, and minerals. It also contains lipids and has high proportions of unsaturated fatty acids (oleic, palmitoleic, linoleic, and linolenic acids). Dandelion is also one of the richest green-vegetable sources of beta-carotene. The health benefits of dandelion are summarized as anti-inflammatory and antimicrobial properties, reduced cholesterol absorption, immuno-stimulatory properties, effects on cardiovascular system, prebiotic activity, and antioxidant properties.

Chicory (*Cichorium intybus* L.) is a perennial plant common in the Mediterranean region and is used as forage for livestock, as supplement to the human diet, or for preparation of folk remedies—all uses are due to its medicinal, culinary, and nutritional qualities. Inulin, coumarins, tannins, monomeric flavonoids, chichoric acid, phenolic acids, and sesquiterpene lactones are some of the major phyto-compounds found in chicory. Chicory is also a source of biologically-relevant elements, such as potassium, iron, calcium, and vitamins A, B1, B2, and C. In folk medicine, it is usually used against constipation and displays choleric and digestion-promoting effects, but also for its appetite-increasing effects, and anti-inflammatory, antifungal, antiviral, and antibacterial activities. It also shows anticarcinogenic, antimutagenic, anthelmintic, immune-stimulating, antihepatotoxic, and antioxidative qualities. Chicory is among the plants, which have been investigated for its potential effects against SARS-CoV-2 [111–114]. Apart from its phytochemical applications, chicory is used in gastronomy as a coffee substitute, and food or drink additive [112, 115]. Namely, chicory's inulin, which belongs to the category of soluble dietary fiber, is a prebiotic ingredient that selectively stimulates the growth of bifidobacteria in the large intestine. As a dietary fiber, chicory inulin is resistant to digestion and absorption in the upper digestive system but is being partially or totally fermented in the large intestine. Chicory's inulin also ameliorates type 2 diabetes mellitus [114].

Milk thistle (*Silybum marianum* (L.) Gaertn.) is a plant that has been used traditionally as a herbal treatment for liver and biliary tract diseases. According to traditional knowledge, it has been used for liver disorders, such as hepatitis, liver cirrhosis, and gallbladder diseases [116–118]. *Silymarin* is the main component derived from the fruits and seeds of milk thistle, which has been found to exhibit antioxidant,

lipid-lowering, antihypertensive, antidiabetic, anti-atherosclerotic, anti-obesity, and hepatoprotective effects [119]. Silymarin is a mixture of flavonolignans containing silibinin, isosilybin, silychristin, and silydianin, but also some minor fractions of other flavanols, such as quercetin and kaempferol, among the others. Studies have shown that silymarin has potential hepatoprotective effects due to its antioxidant and anti-inflammatory effects. Milk thistle is used for treatment of a wide range of disorders of the liver, heart, kidney, and nervous system. Metabolic syndrome, nephropathy, hepatitis, viral infections, cancer, and diabetes have been also reported to benefit from this plant's use. In addition, antimicrobial, anticancer, antidiabetic, skin-protective, heparoprotective, cardioprotective, and neuroprotective effects (Alzheimer's, Parkinson's, ischemia, multiple sclerosis, aging, and depression) have been associated with the use of milk thistle.

Chamomile (*Chamaemelum nobile* L., *Matricaria chamomilla* L.) is one of the widely used medicinal plants; it has been used for preparation of herbal infusions, teas, balms, ointments, and other application forms with numerous healing benefits. It is a member of the daisy family (*Asteraceae* or *Compositae*). It contains a variety of bioactive, among which the flavanoids (apigenin, luteolin, patuletin, and quercetin), coumarins (herniarin and umbelliferone), terpenoids, and mucilage are considered to be the major bioactive compounds. Chamomile is usually used to treat wounds, ulcers, eczema, gout, skin irritations, bruises, burns, canker sores, neuralgia, sciatica, rheumatic pain, hemorrhoids, and mastitis in folk medicine. In the form of an aqueous extract (herbal infusions and teas), it has been used as a mild sedative to calm nerves and reduce anxiety, to treat hysteria, nightmares, insomnia, and other sleep problems. It is also effective in reducing pains associated with arthritis, bedsores and stomach cramps, and back pain. Scientific evidence has also pointed to its anti-inflammatory and anticancer activity, reducing the risks of CVDs, efficacy in the treatments of diarrhea, eczema, sore throat, hemorrhoids, and inhibitory effects on the bacteria that contribute to stomach ulcers (*H. pylori*) [120–122].

Lavender (*Lavandula spica* L.) has been traditionally used in treating parasitic infections, burns, insect bites, and spasms due to its therapeutic properties, as well as treating neurological disorders due to its anxiolytic, mood stabilizing, sedative, analgesic, and anticonvulsive and neuroprotective properties. Lavender oil is usually produced from the flowers of *Lavandula angustifolia* by steam distillation and is composed of many beneficial compounds, such as linalyl acetate, linalool, lavandulol, lavandulyl acetate, and camphor, among others [123–125]. Lavender inhalation aromatherapy is widely used to impart a hypnotic effect, where lavender acts as a mood stabilizer, or enhances the positive feelings, for example, of mothers toward their infants, etc. [126–128]. Aromatherapy massage with lavender essential oil was found to be effective in relieving the pain in patients with knee osteoarthritis [129], but also reducing the severity of primary dysmenorrhea. Other beneficial activities of lavender essential oil are antibacterial, antioxidant, analgesic, and anti-inflammatory effects. There has been also reported a potential wound healing activity of lavender oil in the early phase by acceleration of formation of granulation tissue, tissue remodeling by collagen replacement and wound contraction [130–135].

Linden (*Tilia platyphyllos*, *Tilia cordata* Mill.) is a popular medicinal plant in the Mediterranean region, because of its effects on the central nervous system. Its flowers are usually consumed as herbal infusions or teas, and are widely known for their tranquilizing and analgesic properties, but linden also exhibits hepatoprotective and antioxidant effects. Linden is also a great source of phenolic components, viz. flavonoids, phenolic acids, and others [136, 137]. Linden leaves are usually used for

treatment of colds, stuffy nose, sore throat, breathing problems (bronchitis), headaches, and fever. Linden has also been used for treatments of rapid heartbeat, high blood pressure, excessive bleeding (hemorrhage), nervous tension, trouble sleeping (insomnia), problems with bladder control, and muscle spasms.

Nettle (*Urtica dioica* L.), also known as “stinging nettle,” contains a significant number of bioactive compounds. In particular, the leaves are rich sources of terpenoids, carotenoids, fatty acids, essential amino acids, chlorophyll, vitamins, tannins, carbohydrates, sterols, polysaccharides, isolectins, and minerals. Extracts from the aerial parts of nettles are rich sources of polyphenols, while the roots contain oleanol acid, sterols, and steryl glycosides. Nettles show noticeable activity against both gram-positive and gram-negative bacteria. Due to their rich content of phytonutrients, nettles are suitable for a range of possible applications, such as functional foods, dietary supplements, and pharmacological formulations. This plant is also used as a preservative in foods for both human and animal consumption, but also it has been used in traditional medicine, such as treating the problems associated with hair loss [138–142].

Calendula (*Calendula officinalis* L.) is a plant also known as pot marigold, belonging to the daisy family Asteraceae, which includes approx. 20 herbaceous annual or perennial species. Triterpene alcohols (α -amyirin, β -amyirin, and lupeol), triterpene saponins (calendulosides), flavonoids (quercetin and isorhamnetin), coumarins, carotenoids (flavoxanthin, zeaxanthine, and lutein), and polysaccharides are some of the major classes of phytoconstituents of this plant [143]. Some species of this genus have medicinal values. For instance, *Calendula officinalis* Linn. has been traditionally used in the treatment of various skin tumors, dermatological lesions, ulcers, swellings, and nervous disorders. The aerial parts are used for the treatment of kidney stones and gallstones. The field marigold has been used as disinfectant, antispasmodic, and diuretic agent. In folk medicine, the plant is used as an anti-inflammatory, anticancer, and antipyretic agent. It is known to have wound-healing properties; crushed leaves are usually topically applied on wounds, or are used for treatment of burns. The dried flower heads have been used due to their antipyretic, antitumor, and cicatrizing effects. Topical application of infusion of flowers is used as antifungal and antiseptic in wounds, marks, freckles, sprain and conjunctivitis. Calendula tea is used as eyewash, gargle, or for treatment of diaper rashes and other inflammatory conditions of the skin and mucous membranes [143, 144].

Echinacea (*Echinacea purpurea* (L.) Moench.) is a genus of herbaceous flowering plants in the daisy family (Asteraceae; Compositae) and is commonly called coneflower. It has been used for treatment of respiratory tract infections and inflammatory conditions, including common cold, coughs, bronchitis, and inflammation of the mouth and pharynx. Fresh or dry herbs, dried rhizome and roots, and alcoholic extracts are usually used alone or combined with ginseng, goldenseal, or garlic. Echinacea is also known as an immune stimulant, and there are studies supporting its positive effects on both, innate and adaptive immunity. Furthermore, strong antimicrobial activities have also been reported for echinacea [145, 146].




Feverfew (*Tanacetum parthenium* (L.) Sch. Bip.) is a medicinal plant with numerous bioactive constituents, including sesquiterpene lactones, flavonoid glycosides, and pinenes. It has multiple pharmacologic properties, such as anticancer, anti-inflammatory, cardiogenic, and antispasmodic, as well as has been used as an emmenagogue or as an enema for worms. In folk medicine, feverfew has been used for the treatment of fevers, migraine headaches, rheumatoid arthritis, stomach aches, toothaches, insect bites, infertility, and problems with menstruation and labor during childbirth. Feverfew has also been used for treatments of psoriasis, allergies, asthma, tinnitus, dizziness, nausea, and vomiting [147–150].










St. John's Wort (*Hypericum perforatum* L.) is a herbaceous perennial plant of Hypericeae family [151]. It is well known as a medicinal plant and its extracts are used as a healing and anti-inflammatory agent. St. John's wort extracts contain a number of constituents with biological activity, including phenolic acids, a broad range of flavonoids, naphthodianthrone, and phloroglucinols. The antidepressant activity of *H. perforatum* is mainly attributed to the naphthodianthrone hypericin, pseudohypericin, protohypericin, and protopseudohypericin, but also to the flavonoids. In addition, naphthodianthrone has been discovered to act as an antiviral agent and to inhibit the growth of a variety of neoplastic cell types, while hyperforin has been shown to display antibacterial activity. It has been reported that it also acts as a novel anticancer drug, due to its activity to inhibit apoptosis [151, 152]. Moreover, antidiabetic [153] and anti-inflammatory activities [154, 155], have been also reported.

Red clover (*Trifolium pratense* L.) is a wild flowering plant, which belongs to the family of peas and beans. It is rich in isoflavones and is known for its use in traditional medicine, like for treatment of high blood pressure, arthritis, or used by women in menopause [156–158].

Elderberry (*Sambucus nigra* L.) is a plant that has been used in traditional medicine to heal wounds and burns, as well as for treatment of fever and rheumatism. Also, elderberries are known to boost immunity and have been used for treatment of viral infections, such as influenza A and B, and other respiratory infections. The plant is rich in dietary fibers, polyphenols, and vitamins C and A [159–161].

A brief overview of the use of some Mediterranean plants in folk medicine is given in **Table 5**.

Herb, spice, medical plant	Uses in folk medicine	
Dandelion <i>(Taraxacum Officinale)</i>		<ul style="list-style-type: none"> • Reduces cholesterol and triglycerides' levels. • Lowers blood pressure. • Treats constipation (root); stimulates urination, diuretic. • Treats poor digestion, and increases appetite. • Improves liver function. • Supports production of red blood cells in the body, anti-anemia (leaves).
Oregano <i>(Origanum Vulgare)</i>		<ul style="list-style-type: none"> • Relieves inflammation and joint pain, rheumatism, toothaches, fevers, and menstrual cramps. • Soothes menstrual cramps, toothaches, and fevers. • Regulates digestion. • Helps alleviating flatulence and stomach aches. • Has antiseptic and antifungal properties
Echinacea <i>(Echinacea Purpurea)</i>		<ul style="list-style-type: none"> • Helps treating respiratory and urinary tract infections (antimicrobial) • Disinfects and sanitizes open wounds and prevents infections. • Relieves upper respiratory infections (cough, cold, and throat irritation). • Enhances immunity; anti-inflammatory properties.

Herb, spice, medical plant	Uses in folk medicine
Feverfew (<i>Tanacetum Parthenium</i>) 	<ul style="list-style-type: none"> • Reduces inflammatory pain, fights arthritis, and rheumatism. • Relieves migraine pains and severe headaches. • Treats menstrual cramps. • Helps lowering fever and high body temperature.
Lavender (<i>Lavandula Angustifolia</i>) 	<ul style="list-style-type: none"> • Helps relieve stress, induces relaxation, and sleep (sedative properties). • Sanitizes superficial wounds, burns, and scrapes, and treats acne, eczema, and other skin problems. • Alleviates tension headaches (as inhaled or rubbed into the skin)
Basil (<i>Ocimum Basilicum</i>) 	<ul style="list-style-type: none"> • Relieves indigestion, flatulence, and stomach discomfort. • Heals gastric infections, food poisoning, and improves stomach flu. • Prevents blood clots and anticoagulant properties. • Relieves mosquito bites' itching, swelling, and redness of insect bites (basil poultice).
Bay leaves (<i>Laurus Nobilis</i>) 	<ul style="list-style-type: none"> • Settles stomach discomfort and treats diarrhea. • Alleviates cough. • Eliminates mucus from the respiratory tract in infectious processes.
Chicory (<i>Cichorium Intybus</i>) 	<ul style="list-style-type: none"> • Prevents fungal growth on the skin (topically-applied raw crushed leaves). • Fights sinus infection and gallstones. • Prevents liver damage and intestinal parasites and bacterial infections (tincture of chicory leaves and roots macerated in alcohol).
Valerian (<i>Valeriana Officinalis</i>) 	<ul style="list-style-type: none"> • Treats insomnia. • Lowers anxiety. • Helps with menopause symptoms.
Red clove (<i>Trifolium Pratense</i>) 	<ul style="list-style-type: none"> • Helps with asthma, whooping cough, and gout. • Soothes skin inflammation. • Treats female hormonal imbalances, menopause symptoms, and menopausal discomforts.
Sage (<i>Salvia Officinalis</i>) 	<ul style="list-style-type: none"> • Improves digestion and soothes indigestion and diarrhea. • Reduces night sweats and hot flashes, among other menopause symptoms. • Improves memory and cognition.
St John's Wort (<i>Hypericum Perforatum</i>) 	<ul style="list-style-type: none"> • Soothes anxiety and moderates the symptoms of panic disorder. • Treats minor or moderate depression.







Herb, spice, medical plant	Uses in folk medicine
	<ul style="list-style-type: none"> • Soothes skin injuries. • Alleviates sleep disorders and insomnia.
<p>Dill (<i>Anethum Graveolens</i>)</p> 	<ul style="list-style-type: none"> • Relieves stomach cramps, suppress muscle spasms and soothes stomach pain and irritation. • Treats flatulence. • Supports the immune system in fighting against pathogens.
<p>Calendula (<i>Calendula Officinalis</i>)</p> 	<ul style="list-style-type: none"> • Treats bacterial infections. • Relieves pain and has analgesic properties. • Promotes eye health and prevents AMD. • Uses as dry skin remedy (calendula petals-ointment); Heals bruises, cuts, and wounds.
<p>Nettle (<i>Urtica Dioica</i>)</p> 	<ul style="list-style-type: none"> • Relives allergies symptoms. • Helps reduce internal inflammation, skin swelling, and irritation (leaves). • Has diuretic properties (nettle root). • Promotes hair growth. • Has anti-anemia properties and boosts production of red blood cells in the body (leaves).
<p>Linden (<i>Tilia</i>)</p> 	<ul style="list-style-type: none"> • Treats sleep disorders, including insomnia (linden flowers prepared as tea). • Soothes airways and helps clear airways in congested sinuses. • Relieves muscle cramps or spasms, especially in arms and legs. • Helps digestive functions and relieves indigestion.
<p>Rosemary (<i>Rosmarinus Officinalis</i>)</p> 	<ul style="list-style-type: none"> • Treats stomach aches and renal colics. • Relieves respiratory disorders and muscle spasms. • Acts as a stimulant, dilating blood vessels, and aiding circulatory health. • Reduces joint pain caused by inflammatory diseases, for example, arthritis (topically-applied rosemary essential oil). • Fights hair loss and stimulates hair growth. • Improves memory and overall brain function (tea).
<p>Milk thistle (<i>Silybum Marianum</i>)</p> 	<ul style="list-style-type: none"> • Relieves jaundice. • Manages Hepatitis B and C. • Protects liver.

Table 5.
Mediterranean plants used in traditional medicine in the Mediterranean region.

4. Conclusions

This chapter highlighted the traditional use of spices and herbs in Mediterranean cuisine, and the medicinal plants used as natural remedies in the Mediterranean region. The study also emphasized their diversity and richness in phytonutrients, which greatly contribute to the health and well-being benefits of the Mediterranean diet and lifestyle, recognized worldwide as a highly antioxidant and anti-inflammatory diet; the bioactive compounds in the Mediterranean herbs, spices, and medicinal plants have notable anticancerogenic, antidiabetic, antihyperlipidemic, antihypertensive, and cardio-protective effects. In fact, they act as “*natural health promoters*.” If consumed regularly, they significantly reduce the risks of number of diseases and help maintain good health. Furthermore, the Mediterranean medicinal plants, used for centuries to treat different ailments among the indigenous people in the Mediterranean basin, are rich sources of bioactive compounds and represent nontoxic alternatives and supplements to synthetic drugs, which is in line with the modern trends of using natural products for disease treatment without the side effects of synthetic drugs. Conditions associated with metabolic syndrome, diabetes, inflammation, hyperlipidemia, hypertension, respiratory diseases, anxiety, sleep disorders, and others, have been shown to improve significantly with the use of medicinal plants.

Despite the tremendous scientific advancements in the areas of phytochemical and medical research, this chapter is believed to contribute toward the promotion of the traditional knowledge about Mediterranean herbs, spices, and medicinal plants, used for centuries among the people in the Mediterranean region. These plants along with the Mediterranean dietary pattern and lifestyle could indeed result in a healthier society with reduced incidences of NCDs, cancers, and CVDs.

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