

# Salvia officinalis used in pharmaceuticals

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**Abstract.** The paper presents some pharmaceutical properties of *Salvia officinalis*, a plant belonging the Lamiaceae family, one of the oldest medicinal plants, which play an important role in improving the state of health.

## 1. Introduction

*Salvia Officinalis* L. was discovered by Linneu in 1753, in the East-Mediterranean region and it belongs to the Lamiaceae family [1]. The plants belonging to the Lamiaceae family grow in many parts of the world, some of them being used in order to obtain various food aromas and to improve the quality of products. They also represent a basis for phytochemical products with beneficial effects for health or play an active role in improving the state of health [2].

Gender *Salvia* L. includes almost 900 species spread all over the world, some of which having a great economical value, it being used in the cosmetic industry and in perfumery [3], [4].

This plant has also been used for a long time in traditional medicine to fight fever, rheumatism, perspiration, sexual malfunction, as well as in the treatment of chronic bronchitis or of various mental diseases [5]. The best known species are *Salvia Officinalis*, *Salvia Fruticosa* and *Salvia Lavandulifolia* [6]. *Salvia officinalis* L. (Figure 1) is an evergreen plant, with wooden stems, silver leaves and flowers ranging from blue to purple and which is at present cultivated in various countries [6], [7].



**Figure 1.** *Salvia Officinalis*



Salvia is one of the oldest medicinal plants and the etymology of its Latin name suggests its medicinal properties, the word „salvia” coming from the Latin verb *salvare* = *to save*, which, in this context, has a medical meaning.

From times immemorial, salvia has been used on a large scale in order to add flavor to foodstuffs, as a dried herb or as an essential oil [8].

Recent studies have been done in order to reveal other properties of this plant, such as its anti-inflammatory, anti-microbial, hypoglycemic, anti-diabetes, antioxidant potential, and its capacity to prevent neurovegetative diseases and to stimulate anti-tumor activities [1].

## 2. Chemical composition

Many studies have shown that the plants belonging to the Lamiaceae family show antioxidant and antibacterial activities, due particularly to the quantity and quality of the phenolic compounds it contains. Among these, eugenol, carvacrol and thymol, which are important components of the essential oils and are responsible for the bactericide / bacteriostatic properties. It has also been noticed that the antimicrobial effect of the extract varies from plant to plant and from one region to another, because of various factors, such as: climate, soil composition, type of solvents used in the extraction process etc.

Lately, it has been noticed that some microorganisms have become resistant to antibiotics. For instance, bacterium *Staphylococcus Aureus* is still responsible for the post-surgical infections, while bacterium *Escherichia Coli* causes infections of the urinary tract. Therefore, the researches on the biological active substances to be found in plants have been given increasing importance.

Recently, Kozłowska and collaborators have carried out a comparative study on the chemical composition and the antibacterial activity of the watery (ethanolic and methanolic) extracts from some traditional medicinal plants such as: *Thymus vulgaris*, *Rosmarinus officinalis*, *Origanum Vulgare*, *Mentha piperita* and *Salvia officinalis* [2].

As it is well known, the compounds with predominant medicinal properties are the monoterpenes (thujone, cineole, camphor), the diterpenes (the carnosic acid), triterpenes (the oleanolic acid, the ursolic acid) and the phenolic compounds (the rosmarinic acid) [9], [10].

*Salvia Officinalis* L. contains a large range of monoterpenes with carbon skeletons, including acyclic, monocyclic and bicyclic compounds. The environmental conditions, such as temperature, daytime and light influence the quantitative composition of the essential oil. The variation of these conditions leads to a seasonal metabolism of the plant, which is repeated every year. In *Salvia Officinalis* L. the monoterpenes show an accented dynamic in the period of the vegetative cycle, confirmed by studies carried out in different geographical conditions [11], [12], [13]. Grausgruber-Gröger and collaborators showed that the level of cineole decreases in the vegetation period (May - October), camphor reaches a maximum at the height of the vegetation period, while the thujone concentration grows gradually during the vegetation period [14].

It is also known that *Salvia officinalis* L. contains rosmarinic acid, tannic acid, corosolic acid, fumaric acid, nicotinic acid, etc. [15].

As it has been mentioned before, the antioxidant properties of salvia are mainly due to the presence of the phenolic acids [16]. Recent studies on the chemical composition of Salvia were mainly focused on the hydrophilic compounds deriving from the caffeic acid, over 25 derivatives being isolated and identified from the watery extracts of salvia, the A-E salvianolic acid, the rosmarinic acid and the lithospermic acid. The B – salvianolic acid, discovered in 1981, is a major component of salvia and, due to this, several intensive pharmacological studies have been done on this compound. In a recent study, a new phenolic acid was discovered, called the Y – salvianolic acid, which has the same configuration but seems to behave significantly better than the B – salvianolic acid [17].

## 3. Pharmaceutical use

Salvia is well known in traditional medicine as having antimicrobial properties, it being therefore used as antiseptic, anti-scabies, anti-syphilis, and anti-inflammatory agent, and frequently used in skin and

eye diseases. In some regions of the Middle East, salvia was reported to be used in treating fever and some digestive diseases. The antibacterial properties of the salvia oil have been attributed to the presence of cineole, thujone and camphor [14].

The antimicrobial properties of the essential oil extracted from *Salvia officinalis* have drawn the attention of researchers as they can be used in developing alternatives to traditional antibiotics which prove to be less and less efficient as bacterial resistance to them increases.

It is known that *Escherichia coli*, *Klebsiella pneumoniae* and *Klebsiella oxytoca* are pathogen agents responsible for diseases that can be more or less serious and are transmitted orally and have been detected in various foodstuff. Moreover, all these pathogen agents have become more and more resistant to synthetic antibiotics, which leads to inefficient treatments for some patients. For this reason, the interest in discovering natural antibacterial agents has increased, and these agents can be found in the essential oils of *Salvia officinalis*. The main advantage of using natural agents is that they do not induce antibiotic resistance, such as it happens with the long-term use of synthetic antibiotics [18].

Also, the anti-inflammatory effects of the ursolic acid contained by *Salvia Officinalis* have been studied by Baricevic [19]. *Salvia Officinalis* tea has been traditionally used in the treatment of bronchitis, asthma, angina, mouth tissue inflammation, depressions or in various skin diseases [20], [21]. Carminative, antiseptic and antispasmodic properties of the *Salvia Officinalis* essential oil have been reported. Their effects in the treatment of diseases of the nervous, circulatory and respiratory systems have been brought forth by Loizzo [22]. Alizade and Shaabani explained the antimicrobial activity of the essential oil from *Salvia Officinalis* against *Staphylococcus Aureus* and *Candida Albicans* [23].

*Salvia* essential oil is used externally for inflammations and infections of the soft tissues (stomatitis, gingivitis and pharyngitis) and internally for excessive perspiration and dyspeptic symptoms. *Salvia* leaves and the essential oil possess carminative, antispasmodic, antiseptic and astringent properties [6].

An infusion made of this plant is used for its hemostatic, estrogenic, antiperspirant, antineuralgic antiseptic, hypoglycemic effects, as well as other therapeutic effects, while the essential oil produced from this plant is used in the large scale treatment of diseases of the nervous, circulatory, respiratory systems, as well as some digestive, metabolic or endocrine diseases [24].

A recent study shows that hydroalcoholic extracts from *Salvia Officinalis* are active with the promastigote forms of *Leishmania major* [25].

Usually, cancer therapy involves surgery, irradiation and medicine in various combinations. An efficient medicine treatment should kill the cancerous cells without affecting the activity of the healthy ones. Therefore, the identification of new cytotoxic drugs with low effects upon the immune system has developed into a new field of immune-pharmacological studies. It is known that anti-cancer agents induce an apoptosis, so that the death of the apoptotic cell reduces the sensitivity to treatment. A wide range of natural components of the anti-cancer agents show significant cytotoxic activity that operates in apoptosis. For instance, in a recent study, Zhahneh and collaborators showed that the methanol extract from *Salvia Officinalis* has significant benefic effects in the prophylaxis of leukemia [26].

The plant extracts used in traditional medicine have similar properties. In fact, many diterpenes isolated from some species of plants, belonging to the *Salvia* Gender have proved interesting pharmacological properties: antioxidant, antimicrobial, anti-inflammatory, analgesic, antipyretic, hemostatic, hypoglycemic and antitumor [26].

The antioxidant properties of the compounds isolated from *Salvia officinalis* have been described in [27], [28].

It is known that foodstuffs contain fatty acids and oils that are rich in polyunsaturated fatty acids, which suffer slight oxidation reactions that are not desired in the process of processing (heating up) and neither when stored (addition of salt, freezing). In order to prevent the loss of quality or to delay the effects of oxidation, synthetic phenolic antioxidants are currently in use (butylhydroxytoluene, butylated hydroxyanisole, third-butyl hydroquinone) [29], [30]. For this reason, recent studies have

been carried out on the existence of some polyphenolic antioxidants in some plants such as salvia or rosemary.

Wu [31] used the method of oil stability in order to assess the antioxidant activities of some compounds such as: carnosol, rosmanol, epirosmanol, isorasmanol and the carnosic acid, which represented a remarkable activity comparable to that of the alpha-tocopherol. The rosmarinic acid and carnosol were the main components of all phenolic antioxidant extracts isolated from *Salvia officinalis*.

The increasing interest in the replacement of synthetic antioxidants with natural antioxidants showing the same efficiency could be beneficial both for the increase of foodstuff quality and for a positive influence upon the treatments of various human pathologies [32]. For instance, in [33] it has been demonstrated that the raw ethanolic extract of *Salvia officinalis* has antioxidant properties comparable with butylhydroxytoluene.

*Salvia* is a rich source of phytochemicals, including flavonoids, sesquiterpenoids, diterpenoids, sesterpenes and triterpenes. Some active components such as the rosmarinic acid and acetyl hominin have been isolated from roots of *salvia officinalis*. These compounds, extracts and essential oils reduce in vitro colon, breast and pulmonary cancer and leukemia and reduce the number of oncogenic cells [34], [35].

#### 4. Conclusions

In the last years, a lot of research has been done on the aging process of the human organism. The people's interest in the physical aspect in general and that of the skin in particular has significantly developed dermatology, particularly in its part related to the aging process of the cutaneous organ [36]. A large number of plants and plant extracts are known to have a beneficial effect on the skin. *Salvia officinalis* is well known for the multiple and beneficial impact upon the body, as it has been used to this effect for a long time.

#### References

- [1] Garcia C S C, Menti C, Lambert A P F et al. 2016 Pharmacological perspectives from Brazilian *Salvia officinalis* (Lamiaceae): antioxidant, and antitumor in mammalian cells, *Anais da Academia Brasileira de Ciências* **88** 281-292
- [2] Kozłowska M, Laudy A E, Przybył J et al. 2015 Chemical composition and antibacterial activity of some medicinal plants from Lamiaceae family, *Acta Poloniae Pharmaceutica-Drug Research* **72** 757-767
- [3] Velasco V and Williams P 2011 Improving meat quality through natural antioxidants, *Chil. J. Agric. Res.* **71** 313-322
- [4] Hossain M B, Brunton N P, Barry-Ryan C et al. 2008 Antioxidant activity of spice extracts and phenolics in comparison to synthetic antioxidants, *Rasayan J. Chem.* **1** 751-756
- [5] Alinezhad H, Baharfar R, Zare M et al. 2012 Biochemical activities of acetone extracts of *Hyssopus angustifolius*, *Acta Pol. Pharm. Drug Res.* **69** 617-622
- [6] Raal A, Orav A and Arak E 2007 Composition of the essential oil of *Salvia officinalis* L. from various European countries, *Natural Product Research* **21** 406-411
- [7] Mirjalili M H, Salehi P, Sonboli A et al. 2006 Essential oil variation of *Salvia officinalis* aerial parts during its phenological cycle, *Chemistry of Natural Compounds* **42** 19-23
- [8] Perry N B, Anderson R E, Brennan N J et al. 1999 Essential oils from Dalmatian sage (*Salvia officinalis* L.): variations among individuals, plant parts, seasons, and sites, *Journal of Agricultural and Food Chemistry* **47** 2048-2054
- [9] Lamaison J L, Petitjean-Freytet C and Carnat A, Medicinal lamiaceae with antioxidative activities, potential sources of rosmarinic acid, *Pharmaceutica Acta Helveticae* **66** 185-188
- [10] Cuvelier M E, Berset C and Richard H 1994 Antioxidant constituents in sage (*Salvia officinalis*), *Journal of Agricultural and Food Chemistry* **42** 665-669
- [11] Pitarevic I, Kuftinec J, Blazevic N et al. 1984 Seasonal variation of essential oil yield and



- composition of Dalmatian sage, *Salvia officinalis*, *Journal of Natural Products* **47** 409–412
- [12] Putievsky E, Ravid U and Dudai N 1986 The influence of season and harvest frequency on essential oil and herbal yields from a pure clone of sage (*Salvia officinalis*) grown under cultivated conditions, *Journal of Natural Products* **49** 326–329
- [13] Marie S, Maksimovic M and Milos M 2006 The impact of the locality altitudes and stages of development on the volatile constituents of *Salvia officinalis* L. from Bosnia and Herzegovina, *Journal of Essential Oil Research* **18** 178–180
- [14] Abu-Darwish M S, Cabral C, Ferreira I V et al. 2013 Essential Oil of Common Sage (*Salvia officinalis* L.) from Jordan: Assessment of Safety in Mammalian Cells and Its Antifungal and Anti-Inflammatory Potential, *BioMed Research International* **2013** Article ID 538940
- [15] Monsefi M, Abedian M, Azarbahram Z et al. 2015 *Salvia officinalis* L. induces alveolar bud growing in adult female rat mammary glands, *Avicenna J Phytomed* **5** 560–567
- [16] Lu Y R and Foo L Y 2002 Polyphenolics of *Salvia* - A review, *Phytochemistry* **59** 117–140
- [17] Gong J, Ju A, Zhou D et al. 2015 Salvianolic Acid Y: A New Protector of PC12 Cells against Hydrogen Peroxide-Induced Injury from *Salvia officinalis*, *Molecules* **20** 683–692
- [18] Fournomiti M, Kimbaris A, Mantzourani I et al. 2015 Antimicrobial activity of essential oils of cultivated oregano (*Origanum vulgare*), sage (*Salvia officinalis*), and thyme (*Thymus vulgaris*) against clinical isolates of *Escherichia coli*, *Klebsiella oxytoca*, and *Klebsiella pneumoniae*, *Microbial Ecology in Health & Disease* **26** 23289
- [19] Baricevic D, Sosa S, Della Loggia R et al. 2001 Topical anti-inflammatory activity of *Salvia officinalis* L. leaves: the relevance of ursolic acid, *Ethnopharmacol* **75** 125–132
- [20] Walch S, Tinzoh L, Zimmerman B et al. 2011 Antioxidant capacity and polyphenolic composition as quality indicators for aqueous infusions of *Salvia officinalis* L., *Front Pharmacol* **2** 29–44
- [21] Khan A, Najeib-ur-Rahman, Alkharfy K et al. 2011 Antidiarrheal and antispasmodic activities of *Salvia officinalis* are mediated through activation of K<sup>+</sup> channels, *J Bangladesh Pharmacol Soc* **6** 111–116
- [22] Loizzo M R, Tundis R, Menichini F et al. 2007 Cytotoxic activity of essential oils from Labiatae and Lauraceae families against in vitro human tumor models, *Anticancer Res* **27** 3293–3299
- [23] Alizade A and Shaabani M 2012 Essential oil composition, phenolic content, antioxidant and antimicrobial activity in (*salvia officinalis* L.) cultivated in Iran, *Advances Environment Biol* **6** 221–226
- [24] Istudor V 2001 *Farmacognozie. Fitochimie. Fitoterapie*, Editura Medicala, Bucuresti, Romania
- [25] Serakta M, Djerrou Z, Mansour-Djaalab H et al. Antileishmanial activity of some plants growing in Algeria: *Juglans Regia*, *Lawsonia Inermis* and *Salvia Officinalis*, *Afr J Tradit Complement Altern Med.* **10** 427–430
- [26] Shahneh F Z, Valiyari S, Baradaran B et al. 2013 Inhibitory and Cytotoxic Activities of *Salvia Officinalis* L. Extract on Human Lymphoma and Leukemia Cells by Induction of Apoptosis, *Advanced Pharmaceutical Bulletin* **3** 51–55
- [27] Cuvelier M E, Verset C and Richard H 1994 Antioxidant constituents in sage (*Salvia officinalis*), *J Agr Food Chem* **42** 665–669
- [28] Ben H A, Gajdoova D and Have J 2006 Analysis of *Salvia officinalis* plant extracts by capillary electrophoresis, *J Sep Sci* **29** 1188–1192
- [29] Angelo A J S, Vercellotti J, Jacks T et al. 1996 Lipid oxidation in foods, *Crit Rev Food Sci Nutr* **36** 175–224
- [30] Namiki M 1990 Antioxidants/antimutagens in food, *Crit Rev Food Sci Nutr* **29** 273–300
- [31] Wu Z B, Ni Z Y, Sh Q W et al. 2012 Constituents from *Salvia* species and their biological activities, *Chem Rev* **112** 5967–6026
- [32] Willcox J K, Ash S L and Catignani G L 2004 Antioxidants and prevention of chronic disease, *Crit Rev Food Sci Nutr* **44** 275–295

- [33] Jantova S, Hudec R, Sekretar S et al. 2014 *Salvia officinalis* L. extract and its new food antioxidant formulations induce apoptosis through mitochondrial/caspase pathway in leukemia L1210 cells, *Interdiscip Toxicol.* **7** 146-153
- [34] Liu J, Shen H M and Ong C N 2000 *Salvia miltiorrhiza* inhibits cell growth and induces apoptosis in human hepatoma HePG2 cells, *Cancer Let* **153** 85-93
- [35] Tayarani-Najarana Z, Mousavi S H, Tajfarda F et al. 2013 Cytotoxic and apoptogenic properties of three isolated diterpenoids from *Salvia chorassanica* through bioassay-guided fractionation, *Food Chem Toxicol* **57** 346–351
- [36] Dragomirescu A O 2012 *Actualități în dermatofarmacie și cosmetologie*, Editura Victor Babeș, Timișoara, Romania