



A Mini-Review of the Medicinal Properties of the Lavender Plant and Ways to Increase Its Effective Compounds



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ABSTRACT

Background: This study investigated the medicinal properties of lavender and ways to increase its production.

Methods: To collect relevant data, we reviewed Out of twenty to thirty studies reviewed on the metabolites of this valuable plant and presented the results in the form of a review. Ultimately, we proposed a solution to increase the production of secondary metabolites.

Results: The studies conducted on the therapeutic effects of this plant and the promising results led us to present a plan based on a strategy to increase the production of secondary metabolites. Lavender has been studied in a wide range of diseases and lavender aromatherapy has been shown to reduce anxiety before surgery. It has been found that lavender can be useful in preventing heart damage in people at risk of myocardial infarction and ischemic heart disease.

Conclusion: Various elicitors should be used in tissue culture conditions to produce secondary metabolites effectively.

1. Introduction

Today, plant-based medicine is almost common among societies. Herbal remedies have long been used as medicine by physicians. With the rapid expansion of traditional medicine and the growing interest in herbal treatments, medicinal plants are being used more and more worldwide. Alternative medicine is a term used in industrialized countries to describe medicinal plants. Despite its popularity in developing countries, traditional medicine is expanding rapidly in developed countries. There is significant growth in the global market for herbal medicines, which is currently worth more than \$80 billion per year [1]. Until the 18th

century, many plants were known for their healing properties, their effects on human health, and their treatment methods were known, but their active biological compounds were unknown, as evidenced by the book of medical law by Ibn Sina, an Iranian physician and scientist, which was used until then [2]. Plant bioactive compounds or secondary metabolites are small organic molecules originating from primary plant metabolites. They have a molecular mass of less than 3000 daltons. The chemical nature and composition of plant metabolites vary among species [3]. There are few examples of the chemical diversity of plant metabolites; therefore, they are compounds that cannot be synthesized industrially. Over the past 4000 years,



plant metabolites have been used as medicines and foods since 2600 BC [4]. Using complementary and alternative medicines to treat various conditions is increasing, and interest in their potential has grown worldwide. Herbs have been mostly used from ancient times in medicine, cosmetics, and for preserving and improving the flavor of foods [5-8]. Plants naturally are a rich source of secondary metabolites and therapeutic compounds. The phenolic compounds are the major plant secondary metabolites with antioxidant properties. These compounds are well known for their beneficial effects on human health [9]. It has been implied that the differences in the antioxidant activities of plant extracts can be due to the qualitative and quantitative compositions of the phenolic components. It is stated that the phytochemicals available in plants may differ based on the conditions in which the plant grows and the genetic factors. Herbal medicines are very commonly used in the world. World Health Organization (WHO) estimates that 80% of people on the globe still use traditional herb-based medications due to their low cost, easy accessibility and negligible side effects compared to allopathic medicines [10]. Natural agents are considered a basic source of medicaments and, hence, they are commonly used by the pharmaceutical industries. This situation has led to increased global demand for medicinal plants in the modern era of natural medicine, leading to the exploration and exploitation of new plant sources for their medicinal properties [1, 10, 11]. Lavenders (*Lavandula* spp., *Lamiaceae*) are aromatic ornamental plants used widely in the food, perfume, and pharmaceutical industries. The large-scale production of lavenders requires efficient *in vitro* propagation techniques to avoid the overexploitation of natural populations and to allow applying biotechnology-based approaches for plant improvement and producing precious secondary metabolites. The genus *Lavandula*, belonging to the family *Lamiaceae*, contains many different species. Various *Lavandula* species are geographically grown in many countries.

2. Materials and Methods

To collect relevant data, we reviewed about 50 articles on the medicinal benefits of lavender from several sources such as ScienceDirect, Wiley, Taylor & Francis, Springer, SID, CIVILICA, etc. After studying 50 articles, we selected sources related to medicinal properties and clinical studies from among the articles. From 50 articles, we separated 32 related articles and presented the results and discussion of the articles in the form of a review text. The results of this research were presented in the form of an abstract. Finally, by observing the materials and working methods of most of the articles, a solution was suggested to increase the production of valuable secondary metabolites.

3. Results and Discussion

Lavender (*L. angustifolia*) flowers, buds, and leaves are edible and would be used for flavor broths and jellies (not consumed as a raw material). Lavender scent remarkably

deters moths and flies. Thus the herb is placed in closets and drawers. It should be noted that its insecticidal activities have been shown by the researchers [12, 13]. Infusions and tinctures of lavender flowers have sedative and analgesic properties. Akhondzadeh et al. (2003) found that Lavender tincture alleviates depression, headaches, and anxiety [14]. It has been revealed that Lavender plant extract prevents dementia in rats caused by Alzheimer's disease [15]. Moreover, other effects like cytotoxic behaviors and banning carcinogenic cell growth in lung cancer are reported. [16, 17, 18]. Lavender and its essential oil have been used for centuries due to its antiseptic, antimicrobial and sedative effects. Today, essential oils are also applied to treat conditions such as anxiety, restlessness, insomnia, and depression in modern medicine. Application ways include absorption via the respiratory tract (aromatherapy) or oral ingestion. Despite there being evidence-based information on the pharmaceutical efficacy of lavender oil for the treatment of anxiety-related disturbances, its therapeutic properties were little recognized for a long time due to the lack of larger clinical trials also due to methodological problems in component identification and standardization of such complex multi-content preparations [19]. Lavender extracts are used in the food and pharmaceutical industries because of their health-promoting and nutraceutical effects. Additionally, lavender is regarded as a pharmaceutical plant with predominantly sedative effects employed in aromatherapy. It is shown that there are psychological and physiological effects of lavender rather than antibacterial, antifungal, anti-depressive, and antimicrobial effects [20, 13]. Scientific studies on animals and humans demonstrate that lavender could be effective for anxiolytic, sedative, analgesic, mood regulations and anticonvulsive situations. Also, there are so many works about using lavender in the literature, from infections and ambustion to insect stings. Aromatherapy via lavender oil can be used as an anxiolytic, analgesic, sedative, spasmolytic, mood stabilizer, antimicrobial and wound-healing accelerator. Lavender provides deep sleeplessness with a soothing effect on those with insomnia problems [21-23]. In some countries like Poland, it has been noted that the essential oil of lavender (*L. angustifolia*) could be researched as a part of anti-microbial activities. It was discovered that the essential oil of this plant has an active role against yeasts and molds such as *Candida* sp., *A. niger*, and *P. expansum*, with an MIC 2.5-3 times lower than that for bacteria. *Lavender hydrolates* herb would demonstrate anti-microbial activities against some pathogens like *E. coli*, *P. aeruginosa*, *S. aureus*, *B. subtilis*, *Candida* sp., and *A. niger*. It must be said that essential oils have some abilities from their antioxidant properties. Some other remarkable roles known as antioxidant activity of the essential oil of lavender also has been found by Dapkevicius et al. [16, 24]. Playing some roles, like inhalation from the oil of lavender essential by some animals such as rabbits, has been included as an agent of cholesterol and atherosclerosis reduction in the aorta, but it found no effective cholesterol level in serums [16, 25]. Research has demonstrated some impressive effects of essential oil in lavender which aims to

cure digestive issues, bowel movements' regulators and the biliary tract, which also shows the prevention of flatulence. Some research on mice has proved that inhalation in lavender essential oil could add bile secretion [26] and make the oxidative enzymes' convenient activity [27]. In some noted reports, the essential oil extracted from lavender was a smooth muscle relaxant inhibiting acetylcholine and histamine's contractile response [22]. Lavender plant is mentioned for their aphrodisiac and a qualified impression on hair growth. [28]. Lavender plant hydrolates have refreshing and calming properties and support to cure insomnia and headache. These plants would be mentioned for skin protection and burn therapies [29, 30]. In two sections of hydrolates and fluid rates of lavender, it can be hopefully applied to natural and organic cosmetic products. Linalool and linalyl acetate are other effective compounds of this plant with positive and significant effects on the digestive and central nervous systems. In addition, their analgesic, anti-inflammatory and sedative effects have been proven in various studies (Erland and Mahmoud, 2016). In this context, researchers in 2009 pointed out the significant effect of lavender essential oil in relieving episiotomy pain and obtained promising results in treating this disease with lavender extract [31]. A review article entitled "Pain Control with Lavender Essential Oil" showed that the analgesic effects of lavender in the control of acute and chronic pain varied significantly among different studies due to the nature of the pain and the method of drug administration (e.g., cardiac surgery open, biopsy or hemodialysis); Therefore, further studies with stronger methodology are needed to prove these effects [32]. It is expected that liquids may show similar properties by looking at their chemical compositions, but it is prevalent to research this subject. Our work is to show the summarized information to introduce a valuable plant with chemical and biological characteristics similar to other sources. It should also show more interest among local plant growers. It seems that some modern drugs do not have a good place compared to the synergistic effects of plant secondary metabolites and synthetic drugs because they may help to solve many problems, including microbial resistance to synthetic antibiotics. The results of our studies showed that lavender produces a wide range of lavender metabolites and is also effective in the treatment of a wide range of diseases. Further, by presenting a proposal and solution, we try to find a clear path to increase the production of these metabolites. Provide by plants.

4. Conclusion

Natural foods and their bioactive compounds, such as phenolics, have attracted researchers' interest for a long time because of several biological and pharmacological properties, such as antitumor, antimicrobial, and antioxidant, among others (Alinia-Ahandani et al., 2018; Alinia-Ahandani, 2019; Alinia-Ahandani et al., 2021). Nowadays, various investigations have concerned some nutritional products due to their antioxidant potential to prevent or treat different diseases. The

ethnopharmacological approach and chemical and biological methods may provide useful pharmacological leads. Due to their many biological and pharmacological activities, they have been used in folk medicine. It has been suggested that many flavonoids, aromatic acids, and phenolic compounds are responsible for most biological and pharmacological activities of these natural products, such as plants. The extraction of flowers and leaves of *Lavandula* species and its oil have been used as herbal medicine. In conclusion, natural agents are considered a basic source of medicaments and, hence, they are commonly used by pharmaceutical industries. This situation has led to increased global demand for medicinal plants in the modern era of natural medicine, leading to the exploration of new plant sources for their medicinal properties. In this regard, there is a fundamental problem: plants' low production of these valuable metabolites. In our investigations, most researchers emphasized the medicinal effect of secondary metabolites on the treatment of diseases, while investigating the ways that increase the production of these compounds by plants is of great importance, specifically the use of elicitors in order to increase production. These compounds are of particular importance in tissue and cell culture processes. Specifically, compounds such as growth regulators and nanoparticles can effectively produce secondary metabolites in cell culture and callus culture. We present the scheme below. (Figure 1).

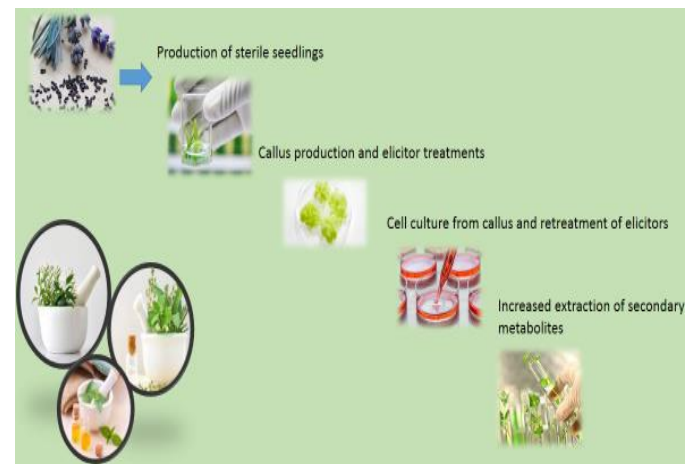


Figure 1: Our proposal

Authors' Contributions

Zeliha Salamoglu, Ebrahim Alinia-Ahandani: Presenting the main idea of the article; editing Final manuscript. Zahra Alizadeh-Tarpoei: Writing an abstract based on the manuscript. Sahebeh Hajipour: writing Manuscript; revising the manuscript; Submitting the article to the journal after final reading. Farjad Rafeie: editing Final manuscript.

Conflicts of Interest

There is no conflict of interest to declare in this research.

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