"The Essential Oil of *Salvia sclarea*: Insights into Its Chemical Composition and Health Benefits"

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ABSTRACT:

Clary sage, or Salvia sclarea, essential oil has attracted a lot of attention because of its distinct chemical makeup and wide range of medicinal uses. The phytochemical profile, which includes its main components including linalool, linalyl acetate, and sclareol, which support its diverse biological functions, is highlighted in this review. Salvia sclarea essential oil is a promising option for use in medicine, aromatherapy, and cosmetics due to its antibacterial, antioxidant, anti-inflammatory, and sedative properties. Recent research also highlights its potential for treating skin disorders, hormonal imbalances, and stress. This article highlights clary sage essential oil's status as a sustainable and natural resource by summarizing the most recent findings on its pharmacological properties, safety, and useful applications. Future research and development directions are also covered, as well as difficulties with its cultivation, extraction, and standardization. The goal of this review is to present a thorough understanding of the potential of Salvia sclarea essential oil as a useful component in health and well-being.

Key word: Salvia Sclarea, linalyl acetate, Terpenoid, Antioxidant etc.

INTRODUCTION:

The clary or clary sage, Salvia sclarea, is a herbaceous perennial of the Salvia genus that can be either short-lived or biennial. It is indigenous to parts of north Africa and central Asia as well as the northern Mediterranean Basin. The plant is currently grown for its essential oil, but it was once used as a herb. An

increasing corpus of pharmacological research is evidencing the traditional medicinal properties of Salvia sclarea, also known as clary sage, and revealing new prospective therapeutic applications.

It is a Mediterranean Basin native perennial herb. Due to its many health advantages, traditional medicine has been using it for generations. Certain types of salvia have antiseptic monoterpenes. It has been noted in recent research on this kind of plant that the chemicals reduce the synthesis of DNA within the cell. This characteristic is crucial for cancer detection and treatment. The aromatic Lamiaceae family includes many species that are used as spices, herbs, perfumes, and traditional treatments. Salvia species are also grown as attractive plants in gardens and parks.

BIOLOGICAL DESCRIPTION:

Salvia sclarea is a herbaceous plant that is either biennial or has a brief lifespan and is a member of the Lamiaceae family of mints. Although it is native to the Mediterranean, its aromatic qualities have led to its cultivation all over the world.

Taxonomy of *Salvia Sclarea:*

Kingdom: Plantae

Clade: Angiosperms

Clade: Eudicots

Clade: Asterids

Order: Lamiales

Family: Lamiaceae

Genus: Salvia

Species: S. sclarea

Figure 1: Salvia Sclarea Plant

GEOGRAPHICAL DISTRIBUTION OF *SALVIA SCLAREA:*

Known by most as clary sage, Salvia sclarea is a herbaceous biennial or short-lived perennial plant that is indigenous to areas of Central Asia and the northern Mediterranean Basin. The distribution of its locations is broken down as follows:

Geographical distribution of *Salvia sclarea*	
Southern Europe	• Italy • France • Spain • Portugal • Greece
North Africa	• Algeria • Tunisia • Morocco
Other Country	• Turkey • Lebanon • Syria • India

Table 1: Geographical distribution of Salvia sclarea

HISTORY AND TRADITIONAL USES:

1. **Ancient and Medieval Uses:**
   - **Greco-Roman Era:** The therapeutic benefits of clary sage have been used by the Greeks and Romans from ancient times. It was highly prized for its capacity to heal a variety of illnesses, such as respiratory disorders, eye disorders, and digestive problems.
   - **Middle Ages:** Clary sage was still widely used in herbal therapy throughout Europe's medieval era. It was thought to have both spiritual and physical advantages and was frequently used as a general tonic.
2. **Culinary and Beverage Uses**:
   - **Renaissance:** Clary sage became well-liked as a flavoring for wines and brews throughout the Renaissance. Its fragrant qualities were employed to deepen the flavors of drinks and improve their aroma and taste.
3. **Aromatic and Perfumery Applications**:
   - **Traditional Perfumery**: Clary sage has been prized for its pleasant scent throughout history. It was frequently employed in perfumery to produce scents with earthy, herbal, and faintly floral overtones. The clary sage essential oil is still a widely used component in contemporary perfumery.
4. **Symbolic and Spiritual Significance**:
   - **Symbolism**: Clary sage has symbolic value throughout many civilizations. Its name "clary" comes from the Latin word "clarus," which means "clear," reflecting its historical connotation of insight

and clarity of vision. Because of its alleged capacity to improve intuition and mental clarity, it was frequently employed in rites and ceremonies.

PHYTOCHEMISTRY OF *SALVIA SCLAREA:*

The phytochemistry of Salvia sclarea, or clary sage, is characterized by a diverse array of bioactive compounds present in its leaves, flowers, and essential oil.

Notable differences in the linalool/linalyl acetate ratio among oil samples from different geographic regions were detected. However, according to available literature, linalyl acetate in Salvia Sclarea essential oil ranges from 2.60% to 56.88%, while linalool content ranges from 8.50 to 40.24. The linalyl acetate content characterizes the fragrance of Salvia Sclarea oil – sweet, green, floral and spicy with a clean, woody, terry and citrus nuance.

Since linalool is a widespread component of flower aroma and can draw a wide range of pollen-carrying insects, it plays an ecological purpose. Other chemotypes have been identified in addition to the commercial grade clary sage oil. These include a methyl chavicol-rich chemotype from Sardinia, a geraniol/geranyl acetate-rich chemotype from Israel, a germacrene D-rich chemotype from Sicily, and α-thujone, thujene, and manool oxide/phytolchemo types from Tunisia.

Table 1 shows that, with the exception of the clary sage samples from Turkey, these 18 components make up up to 80%.

Other noteworthy compounds in this instance included: cadalene (1.60%), valeranone (1.50%), abietal (1.5%), lavandulylisobutanoate (1.50%), isospathulenol (1.2%), δ-selinene (1.10%), salvialenone (1.00%), and 1H-naphtol[2,1-b]pyran (7.00%), which accounted for 87.1% of all compounds found.

The largest group, accounting for 84.57% of the total oil content, was oxygenated monoterpenes, which were followed by sesquiterpenes (12.34%), monoterpenes (1.47%), oxygenated sesquiterpenes (0.61%), and miscellaneous chemicals (1.02%). While diterpenes increased with longer hydro distillation times, linalyl acetate (monoterpene ester) and linalool (monoterpene alcohol) levels appeared to drop.

However, monoterpene and sesquiterpene hydrocarbons have also been detected in the decanted oil of rose, lavender, and palmarosa, as well as substantial concentrations of alcohols (linalool, α-terpineol, and geraniol) in the recovered oil. This is because, in contrast to terpene hydrocarbons, oxygenated molecules are more soluble in water. In addition to geographic origin and distillation method, fertilization and phenological stages affect the amount and quality of essential oil from clary sage. The findings of studies on the composition and essential oil content changes of the aerial portions of clary sage at various phenological stages revealed variations. These discrepancies are thought to be caused by changes in secondary metabolism as a result of abnormalities in metabolic pathways, which in turn affect plant growth and development.

Additionally, fertilization with varying nitrogen rates (0, 1.5, 3.0, 4.5, and 6.0 g N/plant) exhibits notable variations in chemical composition, with the dose of 3.0 g N/plant recording a noticeably greater amount of linalool and linalyl acetate. A valuable natural substance made from clary sage is clareol. Despite having very little scent, sclareol is quite helpful in perfumery because of its "fixing" ability.

This multipurpose diterpene alcohol serves as the precursor to a significant number of flavoring and fragrance compounds. Nevertheless, sclareol spontaneously crystallizes at room temperature and is less volatile than monoterpenes and sesquiterpenes. After full-ripened clary sage seeds were hydro distilled, 0.05% essential oil was obtained, with linalool accounting for 24.25% of the total. This was followed by α-thujene (7.48%), linalyl acetate (6.90%), and germacrene D (5.88%).

Bi-cyclogermacrene, α-copaene, caryophyllene oxide, α-cubebene, geraniol, geranyl acetate, carvacrol, β-eudesmol, humulene epoxide I, cis-alo ocimene, and germacrene B are further noteworthy chemicals.

Country	**Serbia**	**Poland**	**India**	**India**	**Tajikisthan**	**Greece**
Reference	Džamić et al., 2008	Kuzma et al., 2009	Verma, 2010	Sharma and Kumar, 2012	Sharopov and Setzer, 2012	Koutsaviti et al., 2016
Component						
Linalyl Acetate	52.83	2.6	34.51	32.11	39.2	21.9
Linalool	18.18	38.6	40.24	19.1	12.5	19.7
α-terpineol	5	14.3	5.17	7.15	5.5	6.8
Geranyl Acetate	-	5.8	3.03	6.68	3.5	4
Sclareol	0.06	0.1	0.38	3.62	1.2	13.2
Germacrene D	0.84	2.2	-	3.51	11.4.	4.4
Spathulenol	0.13	1.5	-	-	0.2	0.4
Caryophyllene Oxide	0.27	2.2	-	0.55	0.2	0.1
Neryl acetate	0.52	3	1.26	3.27	1.9	2.3
Trans-βcaryophyllen	1.83	1.1	3.15	2.2	2.4	0.7
β-myrcene	1.01	3.4	5.47	-	0.7	1.6
Geraniol	-	7.7	1.76	-	-	2.3
Nerol	0.26	2.5	0.4	-	1.1	1.5
α-eudesmol	-	0.3		2.61	0.8	0.7
Limonene	1.55	0.9	1.76		0.2	0.5
Manool	-	0.1		3.04		1.5
Cis-β-ocimene	32	0.9	1		0.1	1.1
α- and βthujone	-	-			0.9	-

Table 2: Phytochemical of *Salvia Sclarea*

PHARMACOLOGICAL ACTIVITIES OF *SALVIA SCLAREA;*

1. Anti-inflammatory Activity:

Salvia Sclarea plant has contained phytochemicals are: Linalool, Linalyl Acetate, and some flavonoids which are responsible for producing anti-inflammatory effect. Sclareol and major terpenoids found in Salvia Sclarea plant significantly reduce inflammation act by inhibiting pro-inflammatory cytokinin.

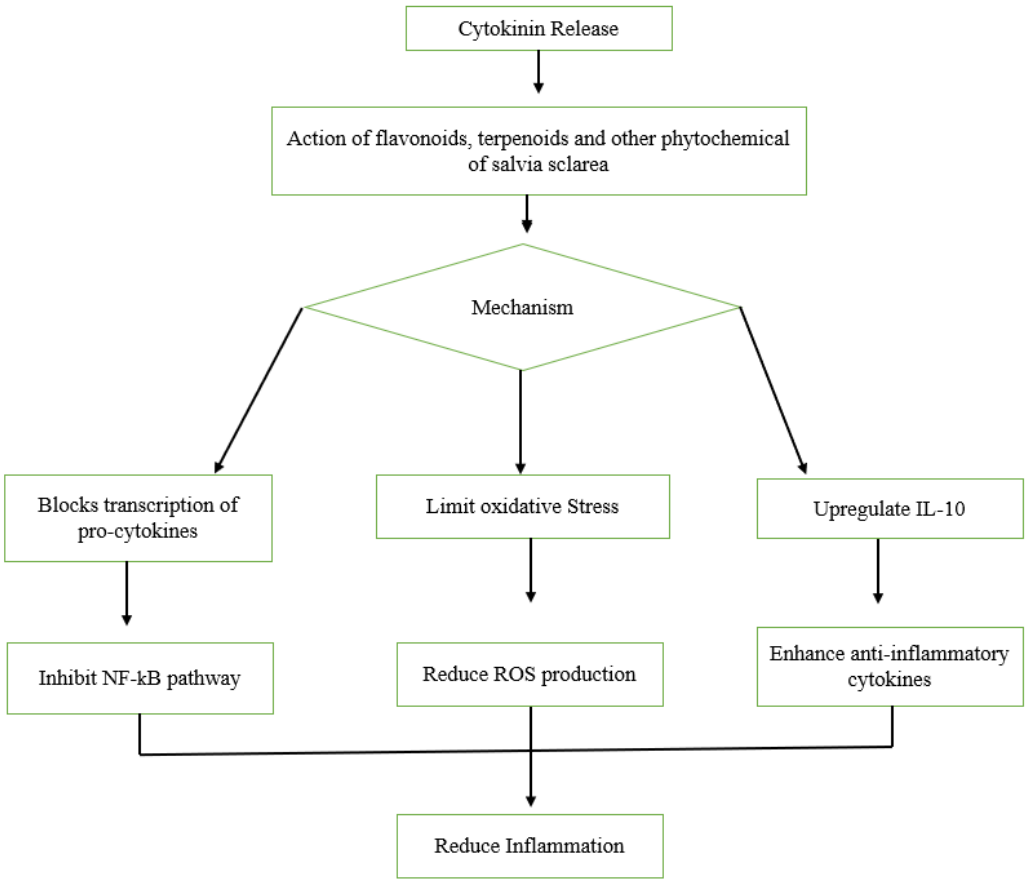

Figure 2: Flow chart of anti-inflammatory activity of *salvia sclarea*

2. Antioxidant Prosperities:

Because of its high concentration of polyphenols, flavonoids, and terpenoids, Salvia sclarea is well-known for having strong antioxidant qualities. Salvia sclarea is a useful plant in the fight against oxidative-related disorders and the promotion of general health because of these chemicals, which scavenge free radicals, lower oxidative stress, and guard against cellular damage. It can be used for anything from food preservation to treating chronic illnesses, inflammation, and aging.

Salvia sclarea hydro methanolic extracts showed strong antioxidant activity in DPPH scavenging and reducing power tests. Its potential for use in nutraceuticals is highlighted in the study. Major constituents including linalyl acetate and linalool were responsible for the potent antioxidant properties of essential oils extracted from Salvia sclarea. In vitro, these oils effectively counteracted oxidative damage.

The polyphenolic content of Salvia sclarea infusions was examined, and it demonstrated exceptional stability and antioxidant activity even in gastrointestinal simulations, indicating that it might be used as a dietary supplement.

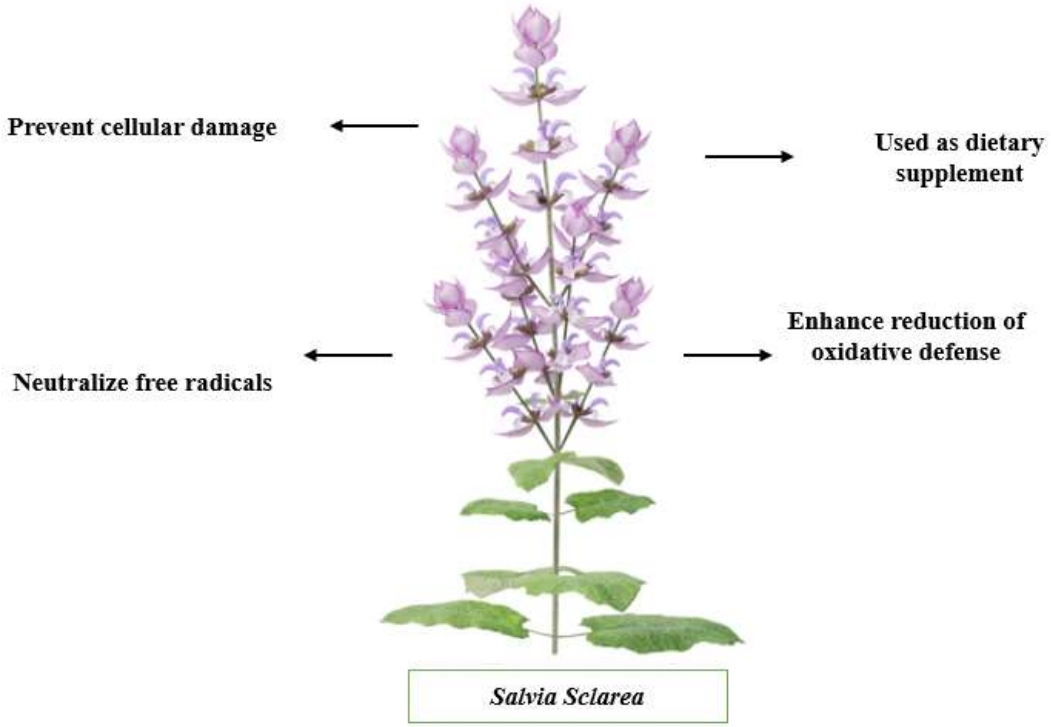

Figure 3: Antioxidant activity of *salvia sclarea*

3. Neuro Protective Effect;

Salvia sclarea extract is hypothesized to protect neurons through multiple pathways: by reducing oxidative stress, combating inflammation, and potentially modulating neurotransmitters. The diagram also shows how these effects are evaluated through specific tests and measurements, ultimately leading to the observed neuroprotective effects.

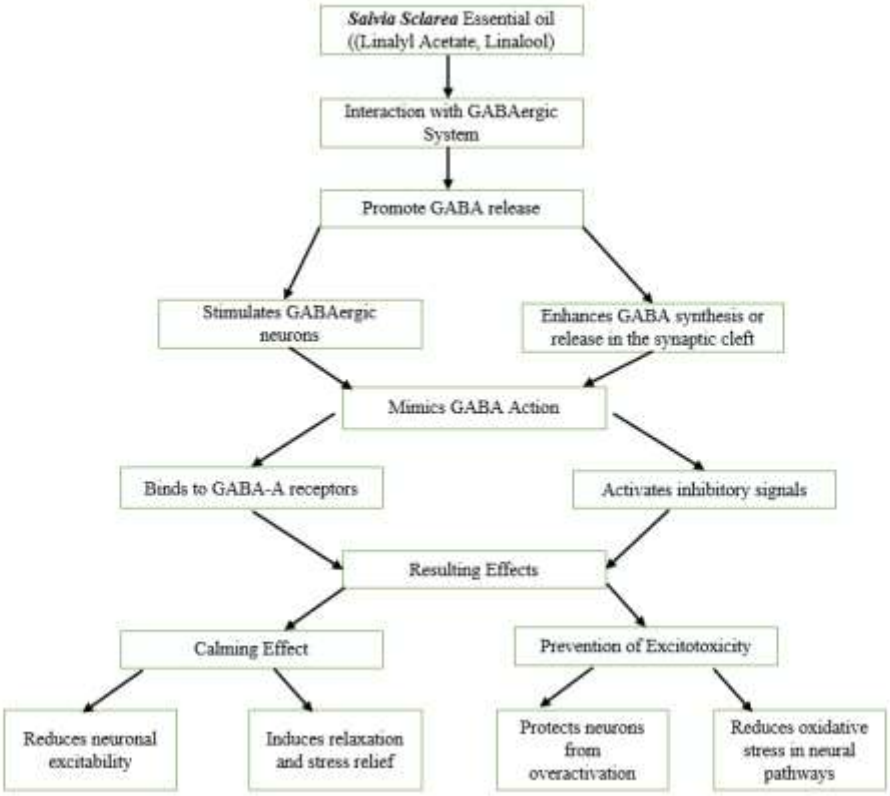

Figure 4: Flow chart of neuro protective effect of *salvia sclarea*

4. Anti-microbial effect:

Several chemicals found in Salvia Sclarea essential oil, such as linalool, α-terpineol, and linalyl acetate, have been demonstrated to be effective against a variety of bacteria, including Pseudomonas aeruginosa, Staphylococcus aureus, and Escherichia coli. It is believed that Salvia sclarea's antibacterial properties stem from its capacity to damage bacterial cell membranes and obstruct their metabolic functions. Its antibacterial activities may also be enhanced by the antioxidant qualities of some of its constituents.

THERAPEUTIC POTENTIAL OF SALVIA SCALREA PLANT;

1. Hormonal Balance:

Salvia Sclarea plant extract is traditionally used to support hormonal balance in female for maintaining and regulating menstrual cycle by control estrogen level. It helps to reduce hot flashes, night sweats and other menopausal symptoms by balancing estrogen level in female.

2. Skin care potential:

Salvia Sclarea Oil is a mystical substance that has been utilized for centuries for its therapeutic benefits, such as calming the scalp and skin. With its earthy scent, it is known to cover over a formulation's disagreeable odor. Furthermore, by controlling sebum, this essential oil minimizes acne outbreaks and is an excellent skin cleanser. The INCI name for the Mediterranean plant known as Clary Sage is Salvia Sclarea. This component has a smooth texture and a purplish-blue tint. Additionally, it has no negative effects and is safe to use.

3. Mental health:

Salvia Scalrea essential oils are reported anti-depressant effect in some research. Aromatherapy frequently uses its soothing scent to elevate mood and lessen tension and anxiety. Clary sage may have anxiolytic and antidepressant benefits, according to some studies, although further research is required to corroborate these claims.

TOXICITY AND SAFTY OF SALVIA SCLAREA:

Due to its high concentration, Salvia sclarea essential oil can be poisonous or irritating if applied to the skin incorrectly or consumed in excess. Because it may cause uterine contractions, it is not advised to use it while pregnant. When applying clary sage oil topically, some people may develop allergic reactions or skin irritation. Patch testing is advised prior to use. Excessive dosages of clary sage essential oil may have sedative effects and may intensify the effects of sedatives or alcohol, causing drowsiness or light-headedness.

CONCLUSION:

With a varied chemical profile full of linalyl acetate, linalool, and other terpenes, the essential oil of Salvia sclarea, often known as clary sage, exhibits exceptional potential as a natural source of bioactive chemicals. It is useful for both medical and cosmetic uses because of these ingredients, which also contribute to its broad spectrum of therapeutic qualities, including as anti-inflammatory, antibacterial, antioxidant, and anxiolytic actions.

Its importance in aromatherapy and holistic health practices is highlighted by new research that supports its significance in enhancing mental health, skin health, and hormonal balance. Nevertheless, even with its encouraging advantages, more research is necessary to fully comprehend the mechanisms of action, ideal dosages, and possible interactions of clary sage essential oil. Standardizing its composition, assessing its long-term safety, and investigating sustainable production and extraction practices should also be the main goals of future research. Clary sage essential oil has great potential to support the natural health and sustainable wellness sectors due to its efficacy and adaptability.

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