Salvia Sclarea Oil:
A Promising Alternative

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Salvia Sclarea Oil: An Overview

Salvia Sclarea, a herbaceous perennial which belongs to the Salvia (Sage) genus of the Lamiaceae family, has been considered as one of the most essential of the 2400 known breeds of the sage family. The herb is cultivated in many regions across the globe for its medicinal properties and for culinary purposes.

Believed to have originated from the eastern regions of the Mediterranean and the southern sections of Europe, Salvia Sclarea, as well as the thousands of species within the Salvia genus, is now cultivated for wide-scale production in many temperate countries.

Because of its long history, Salvia Sclarea is now heralded as one of the oldest and most popular therapeutic herbs. The flower extracts of Salvia Sclarea may be processed for myriads of uses in the food industry, enhancing the flavors of alcoholic beverages, frozen desserts, puddings, gelatins, pastries, and condiments. Because of its alluring aroma, the essential oil of the Salvia Sclarea flower has been exploited by many manufacturers in the hygiene and cosmetics industry, in which the essential oil is used to add fragrance to household cleaning products, soaps, lotions, perfumes, and creams.

As enumerated by Dweck, the many uses of various species of Salvia have been the content of folklores: from therapeutic to flavor enhancing to cosmetic use. For one, Salvia Sclarea has been observed to have antispasmodic properties. The herb's curative properties have also been known to treat digestive problems and kidney conditions effectively.

The sticky seed extracts of Salvia Sclarea have also been used in the treatment of ophthalmic conditions and certain types of tumors. The concentrated extracts of the herb is also known to be effective in the treatment of eye-related complaints. Also, a cold extract of Salvia Sclarea proves effective in removing thorns and splinters from the skin, thus reducing inflammation in the process. The herb's roots, when crushed and processed into powder, may be used as an inhalant to reduce symptoms of headache. And to alleviate inflammation from boils and other skin conditions, an ointment extracted from Salvia Sclarea leaves may be applied on the affected areas of the skin.

In other parts of the globe, Jamaicans use Salvia Sclarea in the treatment of stomach ulcers and eye inflammations. A concentrated extract of the leaves, which is boiled in palm oil, may be used to alleviate scorpion stings. As for the herb's essential oil, research confirms its non-toxicity; thus the oil is generally safe. The leftover material collected during the extraction process of the herb's essential oil may be processed and transformed into sclareolide, which is used to enhance tobacco flavor. In the perfume industry, sclareolide may also be used as a substitute to ambergris.

In a comprehensive essay by Grieve, he narrates how Salvia Sclarea had been used as an adulterant by German wine dealers: First, Elder flowers are added into the mixture and then poured into the Rhenish wine. And later on, the mixture transformed into a Muscatel. The whole process, the essay describes, involved the use of both fresh and dried herb.

In local medicine, the seeds and dried roots of Salvia Sclarea are commonly used. The herb, as the *Encyclopedia of Herbs and Their Uses* reports, may also be processed as an added ingredient to fritters.

The flowers of Salvia Sclarea have also found its place in salad and tea preparations. Culpeper, in his 1652 book, *The Complete English Physician*, describes how the fresh leaves of the herb is dipped in a batter mixture of eggs, flour, and milk, and then fried in butter before serving.

Sturtevant's *Edible Plants* also relates the use of Salvia Sclarea leaves as an ingredient in egg omelets, which encouraged households to cultivate the herb in their gardens, hence its widespread use in Sicily.

Salvia Sclarea oil: Proven Safe and Edible

The U.S. Food and Drug Administration (FDA) has recognized the substances that make up Salvia Sclarea as generally safe for use or consumption; and that Salvia Sclarea is also safe for use as a natural spice, seasoning, or flavoring.

In Israel, the seed oil of Salvia Sclarea has become common in the country's food industry since 2006. Tara Miko, a Coca Cola company based in Israel, enriches its milk chocolate drink products with Omega 3 from Salvia Sclarea seed oil, thus earning Israel's Product of the Year award in 2006. Other Israel-based companies such as Elit and B&D also incorporate Salvia Sclarea seed oil into their products to increase their Omega 3 levels significantly.

Essential Fatty Acids in Salvia Sclarea Oil

Table 1 shows high levels of omega 3 ALA fatty acid in Salvia Sclarea seed oil. Employing the standard method, ISO 5508 & 5509 – Fatty Acid Profile, Miluda Ltd. completed the profiling of the fatty acid contents of Salvia Sclarea seed oil. The seed oil samples were provided by Magnetika Interactive LTD, an Israeli company that cultivates the Salvia Sclarea herb.

The high levels of omega 3 fatty acids (over 50 percent), as shown in Table 1, are attributed mainly to the high levels of alpha linolenic acid in Salvia Sclarea seed oil. Also, results show insignificant to zero levels of saturated fatty acids and trans fats in Salvia Sclarea oil.

Essential Fatty Acids were found in Salvia Sclarea seed oil:

Palmitic acid is the most common type of saturated fatty acid, which can be found in commercially produced oils (Gunstone et al., 1986). Fish oils also contain large amounts of Palmitic acid, ranging from 10% to 30%; also, fats derived from tropical food sources such as coconut contain 6.9% of the saturated fatty acid; and other edible sources such as palm kernel and palm oil contain 6.5%-11% and 32%-59% of palmitic acid, respectively (Gunstone et al., 1986; Horrobin, 1990a, b). Salvia Sclarea seed oil, on the other hand, also contains palmitic acid (6.5%).

Stearic acid – 5% to 30% of stearic acid is found in tallow, 30% - 36% in cocoa butter, and 44% in shea nut butter (Gunstone et al., 1986; Erasmus, 1993). 2.5% of stearic acid is also found in Salvia Sclarea seed oil.

Oleic acid – The most common fatty acid, oleic acid has been detected in virtually all known essential lipids (Gunstone et al., 1986). Significant levels of this fatty acid were detected in olive oil (43.7%-83%), peanut oil (37.9%), and almond oil (65%-70%) (Erasmus, 1993). Additionally, studies show that the metabolic processes among mammals produce significant levels of oleic acid (Gunstone et al., 1986; Erasmus, 1993). About 24% of this fatty acid is found in Salvia Sclarea seed oil.

Linoleic acid – High concentrations of this fatty acid are found in sunflower oils (68.5%), safflower oils (75.3%), and sesame oils (45%) (Gunstone et al., 1986; Erasmus, 1993). In Salvia Sclarea seed oil, Linoleic acid was detected at 14%.

Alpha- linolenic acid – high levels of this fatty acid have been detected in photosynthetic plants, particularly in the leaves, stems, and roots (Gunstone et al., 1986). Flax seed contains more than 50% of ALA, thus is considered as the richest source of this fatty acid, while candlenut and chia ranks close with 30% ALA; hemp seed also follows closely with 20% of this fatty acid (Erasmus, 1993). Other sources of ALA are pumpkin seed oil (up to15%), canola (up to 10%), walnut (3%-11%), and soybean oil (5%-7%) (Erasmus, 1993). Interestingly, Salvia Sclarea contains as much ALA as flax seed (51%).

Table 1: Fatty Acid Profile of Salvia Sclarea Seed Oil

Formula	Fatty Acid Name	(%) Fatty Acid Composition		
		Batch number 1	Batch number 2	Batch number 3
C 14:0	Myristic Acid	0.03	0.035	0.037
C 14:1	Myristoleic Acid	----	----	----
C 15:0	Pentadecanoic Acid	0.01	0.014	----
C 16:0	Palmitic Acid	6.44	6.47	6.524
C 16:1	Palmitoleic Acid	0.07	0.068	0.07
C 17:0	Heptadecanoic Acid	0.05	0.049	0.046
C 17:1	Heptadecenoic Acid	0.08	0.099	0.093
C 18:0	Stearic Acid	2.49	2.567	2.518
C 19:0	0.166	0.168	0.157	
C18:1n9t	Elaidic Acid	----	----	----
C18:1n9c	Oleic Acid	23.89	25.756	23.213
C18:2n6t	Linolelaidic Acid	----	----	----
C 18:2	Linoleic Acid	13.84	13.817	14.009
C 20:0	arachidic Acid	0.12	0.119	0.112
C 18:3 n6	γ-Linolenic Acid	0.26	0.255	0.263
C 20:1	Eicosenoic Acid	0.61	0.632	0.6
C 18:3 n3	α-Linolenic Acid	51.12	49.212	51.727
C21:0	Heneicosanoic Acid	----	----	----
C 20:2 n6	Eicosadienoic Acid	0.05	0.046	0.041
C 22:0	Behenic Acid	0.05	0.056	0.046
C 20:3 n6	Eicosatrienoic Acid	----	----	0.033
C22:1n9	Erucic Acid	0.12	0.128	0.112
C 20:3 n3	Eicosatrienoic Acid	0.03	0.034	0.032
C 20:4 n6	Arachidonic Acid	----	----	----
C 23:0	Tricosanoic Acid	0.01	0.016	0.014
C 22:2 n6	Docosadienoic Acid	----	----	----
C 24:0	Lignoceric Acid	0.04	0.039	0.036
C 20:5 n3	Eicosapentaenoic Acid	----	----	----
C 24:1	Nervonic Acid	0.14	0.152	0.138
C 22:6 n3	Docosahexaenoic Acid	----	----	----

The Nutrition Value of Sage (Salvia Sclarea) Seed Oil

To measure the nutrition value of Salvia Sclarea seed oil, Miluda Laboratories conducted standard methods, the result of which is shown in table 2.

Table 2: Nutrition Value of Sage (Salvia Sclarea) Oil

Parameter	Batch number 1	Batch number 2	Batch number 3
Energy, Kcal/100 g	891	892	895
Moisture, g/100 g	Not found	0.03	Not found
Fat (calculated) g/100 g	98.97	99.11	99.4
Saturated fat, g/100 g	10.07	9.21	10.17
Insoluble matter (hexane), g/100 g	0.07	0.1	0.04
Ash, g/100 g	Not found	Not detected	Not found
Sodium, mg/100 g	<1	Not detected	<1

Microbiology Laboratory Test of Salvia Sclarea Seed Oil

Three sample batches of Salvia Sclarea seed oil were tested for presence of microbes. The laboratory test was conducted by Bactochem Laboratories. Results are shown in table 3.

Table 3: Microbiology Test

Test	Units	Batch number 1	Batch number 2	Batch number 3
Total aerobic mesophilic count	In 1gr	> 10	> 10	> 10
Coliforms	In 1gr	> 10	> 10	> 10
.Salmonella spp	In 20gr	Negative	Negative	Negative
Yeasts/ Molds	In 1gr	> 10	> 10	> 10
E. coli	In 1gr	> 10	> 10	> 10
Aerobic mesophilic spore bearers	In 1gr	> 10	> 10	> 10
Anaerobic mesophilic spore bearers	In 1gr	> 3	> 3	> 10

Active Ingredients

Because Salvia Sclarea oil contains a unique mixture of natural yet rare ingredients, such formula may also hold essential properties that may be used to treat several medical conditions. The essential oil from Salvia Sclarea has been found to have antibacterial, antifungal, anti-inflammatory, antiviral, anti-mutagenic, and astringent properties.

Sclareol, an active ingredient found in Salvia Sclarea oil and is also naturally produced in whales, has been proven to treat a number of medical conditions which many of today's naturally produced essential oils cannot at least alleviate.

Substance	Benefits
Alpha Linolenic Acid (ALA) Omega 3	A form of polyunsaturated fatty acid, Omega 3 ALA fatty acids promote and maintain the normal functioning of cells in the body, thus achieving and maintaining optimum health levels. Interestingly, the major component of Salvia Sclarea oil is Omega 3 ALA (50%).
Oleic Acid (Omega 9)	- Studies show that oleic acid may delay the onset and progression of Adrenoleukodystrophy, an often fatal condition affecting the adrenal glands and the brain. - Aids and improves memory - The interaction of oleic acid with olive oil has been observed to reduce blood pressure. - Significant levels of oleic acid (25%) has been found in Salvia Sclarea Oil.
Lectin extracted from the seeds of Salvia Sclarea	Lectin, one of the many essential components that make up Salvia Sclarea seed extract, has been observed to recognize Tn antigen expression in a number of carcinomas in humans. (J Biomed Sci. 2005;12(1):167-84. Links Lectinochemical studies on the glyco-recognition factors of a Tn (GalNAcalpha1-->Ser/Thr) specific lectin isolated from the seeds of Salvia sclarea).
Omega 3 to Omega 6 Ratio	Having an omega 3 to omega 6 ratio of 3:1, the seed oil extracted from Salvia Sclarea is considered as excellent.
Tannic Acid	Besides having antimicrobial and antiseptic properties, tannic acid has antioxidant, anti-mutagenic, and astringent properties (The effects of resveratrol and tannic acid on apoptosis in colon adenocarcinoma cell line.Department of Medical Biology, Eskisehir Osmangazi University, Medical Faculty, Eskisehir, Turkey).

Substance	Benefits
Sclareol	- Studies show that Sclareol has antioxidant properties in addition to its antibacterial and antifungal properties. - Sclareol not only inhibits cellular growth in human leukemic cells, but it also has cytotoxic properties against such cells. - The effects of doxorubicin, cisplatinum, and etoposide against the MDD2 cell line of breast cancer tissues are enhanced with the interaction of sclareol and the anticancer drugs. - Sclareol has been observed to promote the destruction of Hep-2 cells (J Pharm Sci. 2007 Apr;20(2):146-8. Links). - Flower extracts of Salvia Sclarea, as well as of other natural products, show potent cytotoxic and antibacterial properties. Sclareol also showed a potent antibacterial effect on the following pathogens: - Pseudomonas aeruginosa ATCC 27950 - Enterococcus faecalis ATCC 29212 - Escherichia coli ATCC 25922 - Staphylococcus aureus ATCC 25923
Linalool and Linalyl acetate	Both Linalool and Linalyl acetate have antibacterial, anti-inflammatory, and antifungal properties. Also, they interact and enhance the efficacy of bioactive chemicals (Anti-inflammatory activity of linalool and linalyl acetate constituentsof essential oils Dipartimento di Scienze del Farmaco, Università degli Studi di Sassari, Sassari, Italy).
Manool	Besides its antimicrobial property against Candida Albicans, Staphylococcus Aureus, and Proteus mirabilis, Manool is effective in preventing the clumping of platelets in the blood (Synthesis of manool-related labdane diterpenes as platelet aggregation inhibitors Shionogi Research Laboratories, Shionogi & Co., Ltd., Osaka, Japan), (Transformations of manool. tri- and tetracyclic norditerpenoids with in vitro activity against Plasmodium falciparum Department of Chemistry, Rhodes University, Grahamstown, South Africa).
Caryophyllene oxide	This oxygenated terpenoid, with a potent antifungal property against dermatophytes, is also a popular preservative added in cosmetics, drugs, and food (Use of caryophyllene oxide as an antifungal agent in an in vitro experimental model of onychomycosis. Authors: Yang, Depo1; Michel, Laura1; Chaumont, Jean-Pierre2; Millet-Clerc, Joëlle1).
Sterols	Sterols found in plants cause a significant reduction of bad cholesterol (LDL) levels in the body by decreasing the amount of LDL uptake without affecting levels of good cholesterol (HDL) in the body. And as a food additive, sterols reduce LDL levels in the body by 15% (Katan MB et al. 2003, Mayo Clin Proc. 2003 Aug;78(8):965-78. Review).

Substance	Benefits
Sterols present in Salvia Sclarea seed oil	- Sitostanol - D-5, 23-Stigmastadienol - Chlerosterol - D-7-Stigmastenol - Stigmasterol D-7-Campesterol - B-Sitosterol - D-7-Avenasterol - D-5,24-Stigmastadienol - D-5-Avenasterol - Campestanol
Tocopherols (Vitamin E)	- As an anticoagulant, Vitamin E may help prevent heart attack. - Empirical studies suggest that higher levels of Vitamin E lower the risk of heart diseases in the general population. - By slowing down the oxidative process of LDL, Vitamin E helps hamper the onset of coronary heart disease.
Tocopherols in Salvia Sclarea seed oil	Salvia Sclarea is known to contain forms of Alpha-tocopherol, Beta-tocopherol, and Delta-tocopherol
Coenzyme Q10	Coenzyme Q10 (CoQ10), a compound having similar properties with known vitamins, is found in cells in living organisms. Among other things, the effects of Q10 are the following: - Enhances energy production in the mitochondria of cells - As an antioxidant, CoQ10 effectively scavenges harmful free radicals in the body - Maintains stability of cellular membranes - Helps genes that control the production of energy in cells

The Effects of Salvia Sclarea Seed Oil on Lipid Profile

Table 4: Tests Results of a Two-Month Intake of Salvia Sclarea Capsules

Test preformed	Control Group (No Sage Oil Intake)	Intake of 4 sage capsules per day
Cholesterol	224	181
Triglycerides	228	126
Cholesterol HDL	47.1	57
Cholesterol LDL	132	98.8

Results of Pre-Clinical Tests with Salvia Sclarea

Observed Effects of Salvia Sclarea on Inflammation

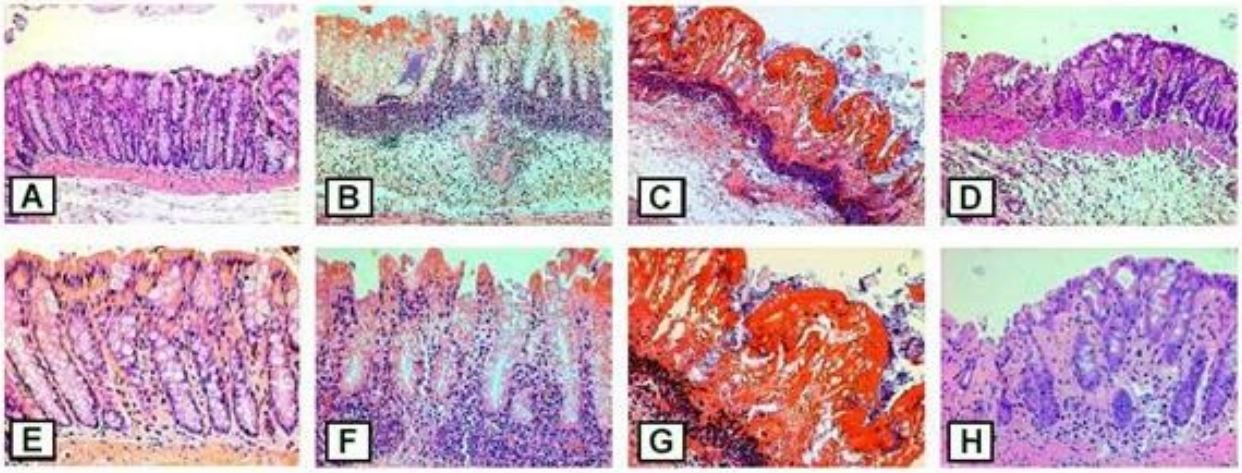
A study conducted in the Hebrew University of Jerusalem highlights the benefits of Salvia Sclarea in comparison with Omega 3 oils found in other food sources such as pure ALA, fish oil, and flaxseed oil—among many others.

The experiment showed that the health benefits of Salvia Sclarea oil are not entirely associated with Omega 3, but may also be attributed to other ingredients naturally found in the extracted oil.

The research, which involved pre-clinical experiments, highlighted the following major findings:

Rats infected with TBNS-induced colitis or DSS-induced colitis were administered with either fish oil or sage oil, which are both rich sources of polyunsaturated Omega3 fatty acids. The two in-vivo models of colitis infection were monitored and the effects of the Salvia Sclarea oil and fish oil were recorded. Results of the test in rats infected with Colitis showed significant reduction in the colon tissue damage.

Histology Results

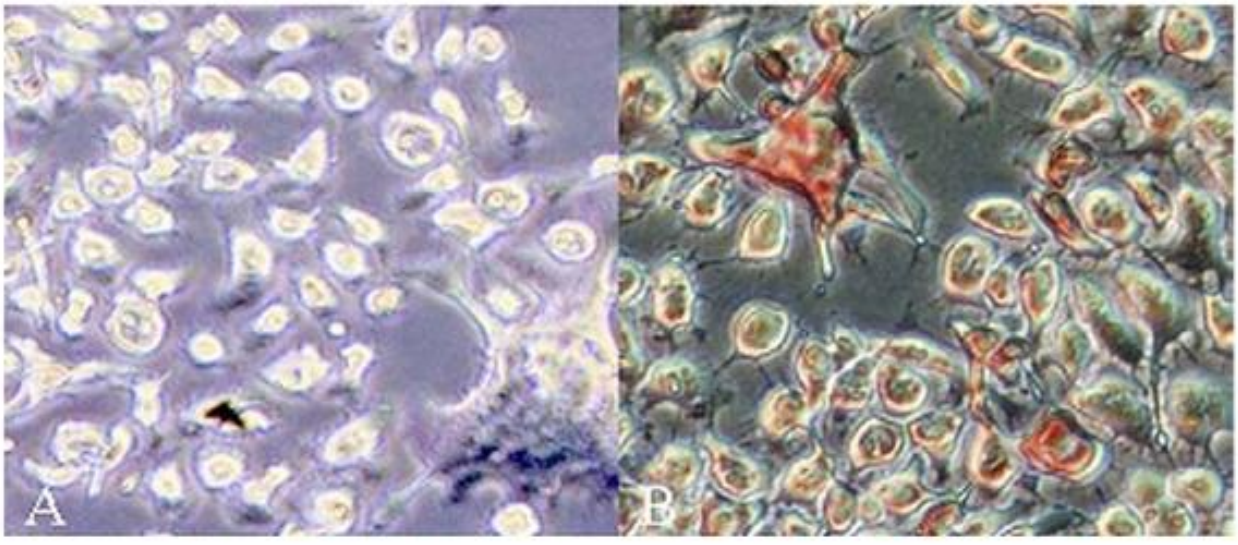


Level of Necrosis in mucosa 0 - level of inflammation in colon - SO+A.0-A,E
Level of Necrosis in mucosa 3 - level of inflammation in colon - CO.3- B,F
Level of Necrosis in mucosa 4 - level of inflammation in colon - FO.3-C,G
Level of Necrosis in mucosa 2 - level of inflammation in colon - SO.2-D,H

Observed Effects of Salvia Sclarea on Hair & Skin

The Department of Biological Chemistry in Hebrew University of Jerusalem in Israel, and Myers Laboratory of Skin Biochemistry and Biology conducted tests to identify the effects of Salvia Sclarea on skin cells, hair follicles, and biological processes such as anti-aging and sebum production. The following effects were observed:

- Potent antioxidant activity in the body
- Prior application of Salvia Sclarea on skin resulted to significant reduction of UV damage
- Reduction of the amount of sebum produced in the skin
- An increase in keratinocyte viability



Considering Flaxseed and Flaxseed Oil as an Omega 3-Rich Source

Because flaxseed and flaxseed oil contain high levels of ALA Omega 3, the U.S. food industry has incorporated such vegetable source to many food products sold today. And although flaxseed and flaxseed oil have been associated with a number of adverse side effects when taken internally, their popularity in the U.S. still remains high. Today, 90% of flaxseed products are sold as ground or plain seeds.

As the demand for Omega 3 rises, more companies who use flaxseed and flaxseed products are still looking for safer alternatives. Such options, if any, are expected to offer the same health benefits of Omega 3 without the adverse side effects of flaxseed and flaxseed products.

The Historical Use of Flaxseed and Flaxseed Oil

Throughout history, the popularity of flaxseed and flaxseed oil is well-documented not because of their use as food or food additive, but because of industrial purposes:

- Manufacturing of linoleum
- Varnish preparation
- Soap production
- Used as a chemical in the production of paint

And in terms of internal intake, flaxseed is only used for medical purposes:

- Used as a laxative (linseed oil)
- Is also an effective demulcent and expectorant

Allergens in Flaxseed and Flaxseed Oil

- At least five allergens have been identified in flaxseed and flaxseed oil (Alonso L, Marcos ML, Blanco JG, Navarro JA, Juste S, del Mar Garces M, Perez R, Carretero PJ. Anaphylaxis caused by linseed (flaxseed) intake. J Allergy Clin Immunol 1996;98(2):469-70).

- IgE-specific allergen, which has a higher molecular weight, was found in flaxseed and flaxseed oil (Lezaun A, Fraj J, Colas C, Duce F, Dominguez MA, Cuevas M, Eiras P. Anaphylaxis from linseed. Allergy 1998;53(1):105-6).

- Three cases of anaphylaxis were observed, the onset of which was attributed to linseed products (Leon F, Rodriguez M, Cuevas M. The major allergen of linseed. Allergy. 2002;57(10):968) (Alonso L, Marcos ML, Blanco JG, Navarro JA, Juste S, del Mar Garces M, Perez R, Carretero PJ. Anaphylaxis caused by linseed (flaxseed) intake. J Allergy Clin Immunol 1996;98(2):469-70) Stricker WE, Anorve-Lopez E, Reed CE. Food skin testing in patients with idiopathic anaphylaxis. J Allergy Clin Immunol 1986;77(3):516-9).

- The increasing use of linseed oil in laxatives, bread, and other products found in health supplement shops and food shops has been associated with the increase in cases of allergies (Leon F, Rodriguez M, Cuevas M. Anaphylaxis to Linum. Allergol Immunopathol (Madr).

- In one study, healthy male and female subjects were administered with 30 grams of flaxseed containing 6 grams of ALA or an equivalent of 12 capsules per day. After the 3-month test period, results showed no significant difference in plasma cholesterol, triglycerides, or platelet aggregation among the subjects studied (Bioavailability of alpha-linolenic acid in subjects after ingestion of three different forms of flaxseed 2008 Apr Cell Biology Laboratory, St Boniface Hospital Research Centre, Winnipeg, Manitoba, R2H 2A6, Canada).

Comparative Results of Sensory Panel Conducted on Flaxseed and Salvia Sclarea Oil

In a central location in Israel in December 2006, a study was conducted which tested the sensory properties of Salvia Sclarea oil and flaxseed oil using sensory panels. In the study, the two known rich sources of Omega 3, which were obtained by using the "cold press" process, were tested among 240 adult respondents who were selected randomly for the sensory research.

After conducting an in-person interview with the respondents, researchers provided a sample of either flaxseed oil or Salvia Sclarea oil to each subject, who, through a Blind Test method, was asked to provide an evaluation of the sensory properties of each sample.

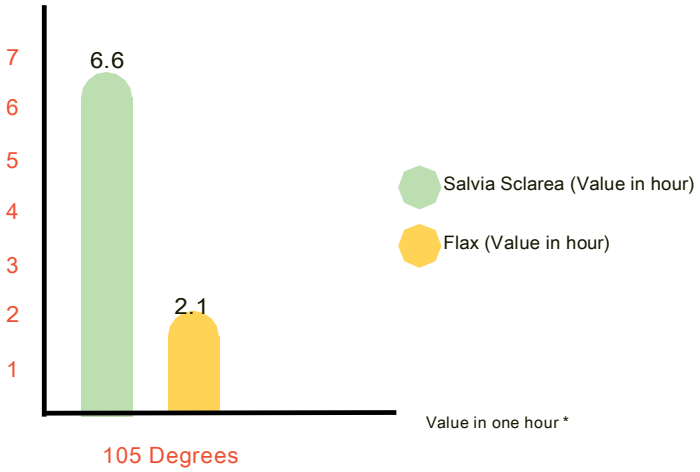
Summary of the Study

The results showed that Salvia Sclarea oil has greater sensory characteristics than flaxseed oil. Nevertheless, with the results combined, both oils equal or even exceed the sensorial profiles of other well-known edible oils available today.

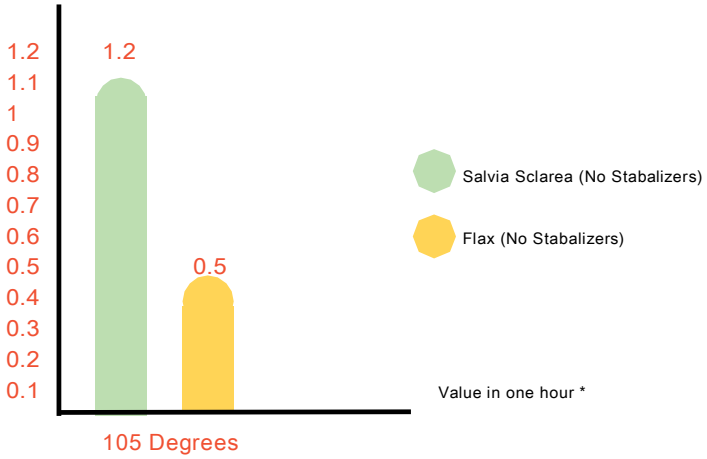
Comparative Study on the Stability between Salvia Sclarea Oil and Flaxseed Oil

To compare the rancidity reaction to Salvia Sclarea oil and flaxseed oil, stability tests were conducted involving batches exposed to varying temperatures. The results of the tests are shown below:

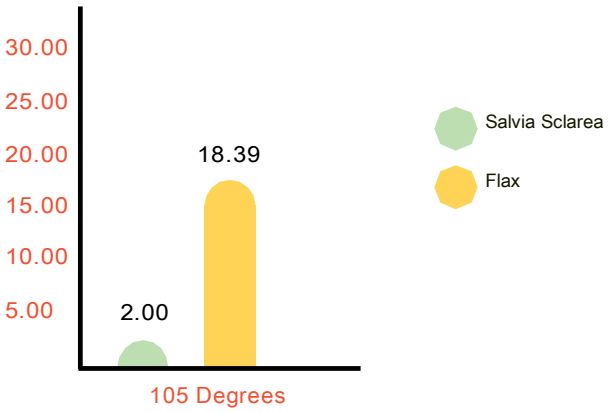
Rancidity Test between Flaxseed Oil and Salvia Sclarea (with stabilizers)



Rancidity Test between Flaxseed Oil and Salvia Sclarea (without stabilizers)



Peroxide value in Salvia Sclarea Oil vs. Flax oil (after 3 months)



Comprehensive Analysis on Salvia Sclarea Oil and Fish Oil

The production of sage oil and fish oil involves two distinct processes. On the one hand, sage oil is extracted through a cold press; and on the other hand, fish oil is produced through a refining process.

The oil refining process results to a uniform and acceptable color, texture, and purity of the end product. Such process also extends the shelf life of the refined oil. By using an oil-based solvent, oil is first extracted from the raw material, after which the extract is cleaned through the removal of oil compounds, phospholipids, lecithin, magnesium, iron, and other impurities. The next stage, the refining process, involves the mixing of the cleaned oil with sodium hydroxide, further removing impurities that contribute to a shorter shelf life. Once the impurities are removed, the oil is heated to 110 degrees centigrade to remove beta carotene to lighten the color of the oil extract. To remove odors, aromatic oils, along with the remaining free fatty acids, are removed by subjecting the extracted oil to high temperatures of 240-270 degrees centigrade for 30-60 minutes. The entire refining process strips the purified oil of impurities, leaving the final extract tasteless and odorless. However, such process also removes essential minerals, vitamins, and other beneficial materials. Thus the final product is not only void of good materials but is also damaged by the high temperatures.

Unlike sage oil, which is produced using cold pressing, fish oil is extracted and purified using the oil refining process.

Concerns on Altering the Ester Structure of Fish Oil

Known to many for its high concentrations of beneficial Omega 3, fish oil, which is extracted from deep-sea fish liver, is often sold in concentrations stored in capsules. However, such end product had already undergone the refining and chemical softening process, as well as the altering of its chemical structure to make it possible for manufacturers to sell the product in capsules. Such complex production stages have attracted scrutiny and criticism in terms of the Omega 3 content of the processed oil. And besides containing traces of trans-fats, the product has been observed to oxidize more quickly.

ALA Conversion to EPA and DHA

Because the human body does not produce its own Omega 3 fatty acids, one must regularly consume food sources rich in Omega 3 ALA. Once inside the body, Omega 3 ALA is converted into Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA).

A recent study, which involved firefighters as test subjects because of the close association of their profession with heart disease, was conducted to determine whether alpha-lenolenic acid, once taken, is converted into long-chain acids having the same concentrations with that of fish oil.

In the study, 62 firefighters in good health condition were divided into six groups. Each group was randomly chosen to receive one of the following daily supplements: (1) 1.2 grams of ALA-rich oil, (2) 2.4 grams of ALA-rich oil, (3) 3.6 grams of ALA-rich oil, (4) 0.6 grams fish oil, (5) 1.2 grams of fish oil, (6) 1.0 gram of sunflower oil. The administration of the daily supplements lasted 12 weeks.

To detect the presence of acids in red blood cells, blood samples are analyzed once every two weeks. The results confirmed that DHA levels increase with the administration of fish oil. Moreover, the results also showed significant increase in the DHA levels of blood samples taken from subjects administered with 2.4 grams of ALA and from subjects administered with 3.6 grams of ALA. The rise of DHA levels consequently increased ALA and EPA concentrations as well.

The 12-week study led researchers to conclude that the intake of ALA-rich food or health supplement significantly raises DHA and EPA levels in the body. The study also discredited previous doubts on the positive correlation of ALA intake to DHA levels in the body (“Flaxseed Oil and Fish-Oil Capsule Consumption Alters Human Composition: A Red Blood Cell n-3 Fatty Acid Trial Comparing 2 Sources of Multiple-Dosing n-3 Fatty Acid,” American Journal of Clinical Nutrition, 2008, 88:801.).

However, it is important to note that the U.S. Food and Drug Administration (FDA) still does not recommend daily intake of more than 3 grams of DHA or EPA (*the Food and Drug Administration report 2 1 CFR Part 184 (Docket)).

Heavy Metals and Toxins Detected in Fish Oil

Because fish oil may contain traces of toxins, dioxins, heavy metals such as mercury, and a number of PCB toxins, most companies claim that their fish oil products meet international standards for safety, and thus do not contain any of the toxic materials. However, the U.S. FDA still places restriction on the intake of fish oil by pregnant and breastfeeding women. Children, according to FDA, are also discouraged to take fish oil because of its potential toxicity to younger populations (Center for Food Safety and Applied Nutrition, "Mercury Levels in Seafood Species," FDA, www.cfsan.fda.gov/~frf/sea-mehg.html, May 11, 2001).

Table 5: Levels of Mercury in Five Fish Oil Samples

Fish Oil Brand Name	Mercury Level, µg/L
CVS	10
Kirkland	>6
Nordic Ultimate	>6
Omega Brite	12
Sundown	>6

Reprints: Kent B. Lewandrowski
Division of Laboratory Medicine
Massachusetts General Hospital
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Digestive Problems Associated with Fish Oil Intake

- Oily stools and, in some instances, diarrhea
- Unpleasant fishy aftertaste and foul-smelling breath
- Hampered absorption of fat-soluble vitamins
- Adverse effects on the normal digestive process, which cause abdominal pains, gas, and heartburn.

Negative Effects of Fish Oil on the Immune System

Tests results show no association between ALA Omega 3 and differentiation of T-lymphocytes. However, prevailing evidence suggests that fish oil, as well as EPA, may have negative effects on the T-cells ("Dietary supplementation with gamma linolenic acid or fish oil decreases T lymphocyte proliferation in healthy older humans," Department of Biochemistry, University of Oxford, UK).

Also, it has been observed that the self-destruction of white blood cells may even be hastened upon intake of fish oil, therefore weakening the body's immune defenses. A study in which doses of fish oil were administered for 12-weeks showed a significant decrease of Interleukin 2 (IL-2), which is primarily responsible in repressing the growth of tumor cells in the body. However, the same study conducted on ALA oil intake showed no adverse effects as compared to that of fish oil.

Moreover, the high Vitamin A and D content of fish oil may result to toxicity once fish oil is taken in higher doses. However, Salvia Sclarea seed oil does not contain such high levels of the fat soluble vitamins.

Increase of LDL Levels with Fish Oil

Although triglyceride levels in the bloodstream are significantly reduced, bad cholesterol (LDL) levels significantly increase after fish oil intake. In fact, such effects are even aggravated among diabetes patients ("Fish Oil in People with Type 2 Diabetes Mellitus," Department of Primary Health Care, Institute of Health Sciences, University of Oxford). Thus it is suggested that medications under the statin family be paired with fish oil to prevent the increase of LDL levels in the body.

Such unfavorable effect of fish oil encourages individuals who regularly take fish oil as Omega 3 supplements to monitor their blood LDL levels on a regular basis. Sage oil, however, has an entirely opposite effect: reducing both LDL and triglyceride levels and, at the same time, increasing good cholesterol levels in the body.

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CHEMICAL ANALYSIS

Laboratory Number 11851

Test Matter: Different Oils

Parameter Tested	011	012	013	014
Oil Stability 105°C	< 10 min	< 10 min	< 10 min	60 min
Fatty acid profile	See attached Table			

Authorized Signature

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Remarks:

1. The laboratory operates in accordance with recognized standards of the International ISO/IEC 17025 in all tests where recognition has been granted.
2. The microbiological tests are recognized and published by the Israel Board of health.
3. The results relate to the sample tested only.
4. Laboratory results are to be used in their entirety and no part may be quoted or copied to other documents.
5. Sampling was provided by and is the sole responsibility of the customer.
6. The Israel Laboratory Accreditation Authority is not responsible for the test results.

Comparative Results between Salvia Sclarea Oil and Other Oils

Table 6: Comparative Data

Benefit	Salvia Sclarea Oil	Fish Oil	Flax Seeds oil
Presence of Essential Fatty Acid	Yes	Only ALA is detected in fish oil	Yes
Stability	Excellent	Quickly oxidizes, thus considered unstable	Quickly oxidizes, thus considered unstable
Maximum dosage (to curb possibilities of internal bleeding)	No dosage limit	Maximum daily dosage of 3 grams or an equivalent of two servings (portions) of fish per week	(further tests needed)
Presence of Allergen	None	Fish and other seafood are widely known to contain allergens	Flax itself is a well-known allergen
Sensory properties (taste and smell)	Excellent taste and smell	Unpleasant fishy taste	Some individuals report bitter after taste after intake
Presence of toxic materials	None	Heavy metals have been detected in fish oil due to increasing levels of pollution in the ocean	Cynic glycoside, a toxic material, has been detected in flaxseed
Levels of Omega 3 ALA fatty acid	Up to 55% ALA	20%-30% of EPA and DHA	Up to 55%
Regarded as safe for pregnant women, nursing women, children, vegans, and vegetarians)	Yes	Besides a number of Kosher requirements, fish oil may not be recommended for vegetarians and vegans	The high levels of phytoestrogens detected in flaxseed prove unsafe for children, pregnant women, and lactating women