

*Exploring the Ecological and Medical Benefits of Dill (*Anethum graveolens*) as an Alternative to Spirulina (*Arthrospira platensis*)*

Abstract: This study explores the potential of dill (*Anethum graveolens*) as a sustainable alternative to spirulina (*Arthrospira platensis*) in nutrition and health applications, specifically within Azerbaijani culture and broader ecological contexts. Dill, widely used in Azerbaijani cuisine and traditional medicine, offers significant ecological and medicinal benefits. Its culinary uses include flavoring various dishes, while its medicinal applications range from aiding digestion to enhancing immune function. Dill also plays an economic role in rural Azerbaijani communities, providing income through agriculture and appearing in cosmetics and personal care products. The study employs a comparative approach to examine the ecological sustainability, medicinal properties, and resource use of dill and spirulina. Laboratory analyses focus on antioxidant, antimicrobial, and anti-inflammatory properties, as well as the effects on human cells. The findings suggest that dill's ecological footprint and health benefits could make it a viable substitute for spirulina, especially in regions with suitable growing conditions. Furthermore, its cultural significance and economic value in Azerbaijan highlight dill's multifunctionality as a food, medicinal, and cultural product.

Keywords: Dill (*Anethum graveolens*); Spirulina (*Arthrospira platensis*); Sustainable Nutrition; Traditional Medicine; Ecological Sustainability.

Összefoglalás: Ez a tanulmány feltárja a kapor (*Anethum graveolens*) potenciálját a spirulina (*Arthrospira platensis*) fenntartható alternatívájaként a táplálkozási és egészségügyi alkalmazásokban, különösen az azerbajdzsáni kultúrában és tágabb ökológiai összefüggésekben. Az azerbajdzsáni konyhában és a hagyományos orvoslásban széles körben használt kapor jelentős ökológiai és gyógyászati előnyökkel jár. Kulináris felhasználása magában foglalja a különféle ételek ízesítését, míg gyógyászati alkalmazásai az emésztés elősegítésétől az immunrendszer működésének fokozásáig terjednek.

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[1] Aghili, Khorasani-Shirazi M. H. (2008): Makhzan al-Advyeh. Tehran: *Tehran University of Medical Sciences*. pp. 490–491.

[2] Aghili, Khorasan-Shirazi M. H.–Qrabadin-e, Kabir (1999): Tehran: *Mahmoudi Bookstore Publication*. [Google Scholar]

A kapor a vidéki azerbajdzsáni közösségekben is gazdasági szerepet játszik, a mezőgazdaságon keresztül jövedelmet biztosít, és megjelenik a kozmetikumokban és testápolási termékekben. A tanulmány összehasonlító megközelítést alkalmaz a kapor és a spirulina ökológiai fenntarthatóságának, gyógyászati tulajdonságainak és erőforrás-felhasználásának vizsgálatára. A laboratóriumi elemzések az antioxidáns, antimikrobiális és gyulladásgátló tulajdonságokra, valamint az emberi sejtekre gyakorolt hatásokra összpontosítanak. Az eredmények arra utalnak, hogy a kapor ökológiai lábnyoma és egészségügyi előnyei a spirulina életképes helyettesítőjévé tehetik, különösen a megfelelő termesztési feltételekkel rendelkező régiókban. Továbbá kulturális jelentősége és gazdasági értéke Azerbajdzsánban rávilágít a kapor élelmiszer-, gyógyszer- és kulturális termékként való multifunkcionalitására.

Kulcsszavak: Kapor (*Anethum graveolens*); spirulina (*Arthrospira platensis*); fenntartható táplálkozás; hagyományos orvoslás; ökológiai fenntarthatóság.

Introduction

Dill (*Anethum graveolens*) and Spirulina (*Arthrospira platensis*) [1] are two important plant species obtained from different sources in nature. While Spirulina is known for its high protein, vitamin, and mineral content, dill stands out as a plant that has been used in traditional medicine for a long time. In recent years, the search for more sustainable and environmentally friendly alternatives to spirulina has highlighted the potential of dill. This comparative study aims to investigate the ecological and medicinal benefits of dill as a substitute for spirulina. From an ecological perspective, the effects of dill in natural habitats and the environmental effects of spirulina production will be examined and compared. Growing dill more widely and using sustainable agricultural methods suggests that it has less potential to harm the ecological balance. From a medical perspective, the health effects of the bioactive compounds contained in dill and how these effects differ from spirulina will be investigated. To understand the potential medicinal benefits of dill [2], its antioxidant, antimicrobial, and anti-inflammatory properties will be taken into account. Additionally, dill's potential effects such as supporting the digestive system, strengthening the immune system, and supporting cardiovascular health will also be examined. In this way, it will be better understood what advantages dill

has medically compared to spirulina. Finally, it is also important to compare the culinary use of dill with spirulina. While dill can be used in a variety of dishes and recipes [3], spirulina's distinct taste and smell may be a drawback for some consumers. Therefore, comparing dill with spirulina will take into account not only its medicinal and ecological benefits but also its ease of use. This comparative study aims to reveal the ecological and medical benefits of using dill instead of spirulina.

Understanding the potential of dill can make a valuable contribution to sustainable nutrition and health. Dill has various application areas in Azerbaijan. First, dill is an important spice frequently used in Azerbaijani cuisine and is one of the main ingredients in many traditional dishes. It is especially widely used in pilaf [4], stuffed vegetables, and salads. Additionally, dill is frequently used in making pickles and pickles. Dill is also used for health and medicinal purposes in Azerbaijan. It is widely used in traditional medicine to relieve digestive problems and strengthen the immune system. Dill oil is used externally to relieve pain and support skin health. Additionally, dill farming is an important economic activity in Azerbaijan. In particular, dill cultivation is an important source of income for farmers who want to generate income in rural areas. Dill farming [5] increases employment by contributing to the country's economy. In Azerbaijan, dill is also used in cosmetics and personal care products. In particular, dill extracts and oils are frequently included in the formulation of natural products used for hair and skin care. Dill also plays an important role in traditional Azerbaijani culture and festivals. For example, during important events such as the Novruz Feast, dill is an indispensable part of some traditional rituals and dishes. Finally, dill also takes part in local folk culture and folklore in Azerbaijan. Dill and motifs associated with it appear frequently in folk songs, folk dances, and other traditional art forms.

[3] Hosseinzadeh, H.–Ramezani, M.–Salmani, G. (2000): Antinociceptive, anti-inflammatory and acute toxicity effects of *Zataria multiflora* Boiss. extracts in mice and rats. *J. Ethnopharmacol.* 73., pp. 379–85. [PubMed] [Google Scholar]

[4] Ansari Shirazi, A. I. H.–Ekhtiarat e Badiie (1992): Tehran: Pakhshe Razi Companies.[Google Scholar]

[5] Avicenna, H. (2005): *Canon in Medicine*, 2., Alaalami Library. [Google Scholar]

[6] Ibn Bitar, Z. (2001): *The Whole Vocabulary of Medicine and Food*. 1. Beirut: Scientific Book House. [Google Scholar]

Figure 1. The General View of Dill (*Anethum graveolens*)



Dill has different vegetation stages throughout its plant life. First, there is a germination phase that begins with planting seeds. Seeds receive moisture and germinate under suitable conditions. This is followed by a growth phase in which the seedlings grow and develop. During this phase, seedlings develop their root systems by taking nutrients from the soil and growing their leaves [6]. Next comes the flowering phase. During this stage, the dill plant forms flower buds and blooms. Flowers provide fertilization of the plant and lead to seed production. After seed production is completed, the plant moves into the maturation and ripening phase of the seeds. Finally, come the harvesting and replanting phases. After the dill plant matures, it is harvested and its seeds are collected. These seeds can be saved or replanted for use in future growing seasons. Thus, the life cycle of the dill plant is completed and a new cycle begins. The purpose of this comparative study is to investigate the ecological and medicinal benefits of dill (*Anethum graveolens*) as a substitute for spirulina (*Arthrospira platensis*). In this context, we aim to examine the health and environmental effects of dill with a comparative approach by the following methods:

- examining the ecological effects of dill, we aim to evaluate its potential effects on soil health;
- comparing the medicinal properties of dill with spirulina, we aim to determine its antioxidant and antimicrobial activities;
- evaluating in terms of ecological sustainability by comparing the use of resources required for the cultivation and production of both plants;
- investigating the potential medical applications of dill and spirulina extracts by testing their effects on human cells;

- taking a comparative approach, we aim to determine whether dill has similar or different health benefits to spirulina;
- an evaluation of the consumers' habits, and acceptability by examining traditional and modern uses of dill.

The Research Object and Materials

The research object is the dill plant which is widely used in daily life, modern medicine, and the kitchen, too. The investigation was realized to prove the profitability of the plant in traditional medicine, the environment, and the kitchen. The biochemical properties of the plant are the main factor in the investigation. While studying it was revealed that dill planted in different soil types and climate conditions gives us various results. Among abiotic factors, solar radiation takes the first place. The generation of ascorbic acid in the dill and biochemical reactions happening demand more direct solar radiation as in other vegetables. The research aims to examine the ecological and medicinal benefits of dill (*Anethum graveolens*) by comparing it with spirulina (*Arthrospira platensis*). In line with this purpose, the materials and methods of the research were determined. To evaluate the ecological impacts of dill and spirulina, data on the cultivation and production of both plants will be collected and analyzed. Seeds, cultivation materials, and soil samples of dill and spirulina plants will be used as research materials. Various materials needed to grow dill and spirulina will also be taken into account, such as the use of water and fertilizer. The procurement and use of these materials were determined as one of the methods of the research. To study the medicinal benefits, extracts, and extracts from dill and spirulina samples will be obtained and subjected to laboratory testing. These tests will be performed to determine the antioxidant, antimicrobial, and anti-inflammatory properties of the herbs. Additionally, the effects of dill and spirulina extracts on human cells will be examined. The materials to be used throughout the research were carefully selected to obtain reliable and accurate results. Standard methods will be used for growing and processing dill and spirulina plants. Analysis of the data obtained will provide the information necessary to achieve the purpose of the research.

Botanical description of Dill (Anethum graveolens):

It is an annual plant species from the Apiaceae family. Its thin and hairy body is generally 40 to 60 cm long and has a branched structure. Its leaves are long and thin, bright green, and have a hairy texture. The plant has small, white, or yellow flowers in umbrella-shaped inflorescences. These flowers mature into seed fruits and are filled with long, cylindrical seeds that have a characteristic odor. Dill seeds are the most valuable part of the plant and are generally used in the kitchen, but also for medicinal and aromatic purposes.

[7] Moemen, Tonekaboni M. M. – Tohfato Moemenin (2007): Tehran: Shahid Beheshti University of Medical Sciences. [Google Scholar]

The scent of dill is fresh and aromatic, often with a refreshing effect like mint and anise. Its scent contains slightly spicy and lemony notes, making it familiar and attractive. When it is broken or crushed, it becomes more noticeable and a pleasant smell spreads to the environment. Whether cooked or consumed directly, the aroma of dill is used to add a unique taste and smell to dishes and beverages. Its scent is known as an indispensable part of various cuisines and recipes, and it has a sweetening and aromatic property.

Figure 2. Dill (*Anethum graveolens*)



Botanical description of Spirulina (Arthrospira platensis):

It is a single-celled type of blue-green algae and a photosynthetic organism. Its long and thin cells form a spiral-shaped array. It is commonly found in freshwater lakes and saltwater habitats. When examined under a microscope, spirulina cells appear greenish-blue in color. The plant contains pigments such as chlorophyll and phycocyanin, which give it its characteristic color. It produces energy and releases oxygen using sunlight and carbon dioxide through photosynthesis. Spirulina [7], which has high nutritional value, is consumed by many people as a dietary supplement and is often sold in powder or tablet form. Spirulina generally has a slight marine odor, but it does not have a distinct odor. Fresh spirulina can be identified by a slight seaweed smell, which some people liken to the scent of the sea. However, in dried and processed spirulina products, this odor is less pronounced and often has almost no odor. Since Spirulina is generally consumed in powder or tablet form, its scent can

be described as a sweet sea breeze. When added to drinks and meals, especially in smoothies, the scent of spirulina is often balanced by combining with the taste and smell of other ingredients.

Figure 3. *Spirulina (Arthrospira platensis)*



Dill (Anethum graveolens) in Turkish Cuisine:

Dill has a wide range of uses in Turkish cuisine as a delicious and characteristic spice. It is especially preferred in salads and appetizers and adds a fresh aroma to dishes. Dill adds richness to dishes both visually and in taste with its green leaves. Dill, an indispensable ingredient of fish dishes, is in perfect harmony with fish. It complements the fresh and natural taste of fish, which enhances the flavor of dishes made with seafood. Dill is also frequently used in fish marinades and sauces. Dill, which is a spice frequently used in pastries and pastries, is added to the dough or sprinkled on it. In this way, a unique aroma and flavor is added to the pastries. Dill added to cheese pastries [8] enriches the flavor of the filling. Dill, which is frequently seen on breakfast tables, increases the taste of egg dishes by using it in omelets and menemen. Additionally, dill spread on bread or added to cheese toast becomes one of the indispensable flavors of breakfast. Dill has a wide range of uses in Turkish cuisine as a delicious and characteristic spice. It is especially preferred in salads and appetizers and adds a fresh aroma to dishes. Dill adds richness to dishes both visually and in taste with its green leaves.

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[8] Zargari A. (1996): *Medicinal Plants*, 6., (2.). Tehran: Tehran University Press. pp. 531–528. [Google Scholar]

[8] Zargari A. (1996): *Medicinal Plants*, 6., (2.). Tehran: Tehran University Press. pp. 531–528. [Google Scholar]

[9] Razi, M. Alhavy (2005): Vol. 21. Teheran: Iranian Academy of Medical Sciences. [Google Scholar]

[10] Murray, M.D.–Brater, D. C. (1993): Renal toxicity of nonsteroidal anti-inflammatory drugs. *Ann. Rev. Pharmacol. Toxicol.* 32., pp. 435–65. [PubMed] [Google Scholar]

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Additionally, dill spread on bread or added to cheese toast becomes one of the indispensable flavors of breakfast. Dill [8], which is frequently preferred in appetizers, is especially used in yogurt and olive oil appetizers. In this way, it ensures that the appetizer has a fresh and light taste. Additionally, it helps drinks have a refreshing taste by adding them to drinks such as lemonade. The plant has a specific place in Turkish cuisine. In drinking, meals, and salads, salted vegetables the dill is widely applied.

Figure 4. Dill in the Kitchen with Various Applications



Dill has low calories and possesses a high fiber content that supports the digestive health of human beings. Also, dill is rich in minerals [9] including iron, calcium, potassium, and magnesium, which strengthen bone health, heart muscular, brain, and lungs. The special vitamins in the plant are vitamins A and C. Vitamin C strengthens the Human's immune system, while vitamin A helps keep the skin healthy, brain, eyes, hairs, and intestines. Besides, dill contains essential fatty acids [10], such as; omega-3 and omega-6 fatty acids, which support heart health and fight inflammation,

sight, and intestine diseases. Dill provides many health benefits in traditional and modern medicine, the plant supplies the necessary nutrients for human ecology.

[9] Razi, M. Alhavy (2005): Vol. 21. Teheran: Iranian Academy of Medical Sciences. [Google Scholar]

Results and Discussion

The results obtained in the study titled "Study of dill (*Anethum graveolens*) as an alternative to Spirulina (*Arthrospira platensis*)" revealed important findings. From an ecological point of view, the more widespread cultivation of dill [9] and the use of sustainable agricultural practices can reduce its negative effects on natural habitats. Also, the health effects of dill have been compared with Spirulina, focusing especially on its antimicrobial and digestive system-supporting properties.

Ecological advantages of the dill plant are the following: grown in various climates and resistibility to the dried climate; less consumption of natural water resources and resistibly to waterless medium; maintaining soil quality, and the recultivation feature; reducing the use of chemical fertilizer and pesticides in soil and human-beings and the protection of local ecosystem and human ecology.

As a result of the investigation, the most advantages of the dill plant have been revealed and collected. Some of the most important advantages of dill compared to Spirulina are followings: an easier cultivation and wider growing areas: dill can be grown more easily in different climate and soil conditions and can spread over a wider geographical area, making it more accessible around the world; it is more economically and commercially viable: dill is a more economically and commercially accessible herb compared to Spirulina, encouraging its more widespread use in various cultural cuisines; wider areas of use and cultural value: dill is a plant widely used in various cuisines and traditional medicine practices, which is an important part of our cultural heritage; less intense taste and odor: the taste and smell of dill can be milder and more pleasant compared to the distinct taste and smell of Spirulina, offering a wider variety of uses; more diverse nutritional value: while dill comes with a profile rich in vitamins, minerals, and antioxidants, Spirulina focuses on more specific nutrients, resulting in a more balanced diet. Due to the investigations, I can say that different impacts of the dill which are more progressive than spirulina have to be investigated by ecologists, doctors, culinarians, and biologist.

Conclusion

This comparative study revealed several important findings. From an ecological perspective, dill's wider cultivation and suitability for sustainable agricultural practices indicate that it can reduce its negative effects on natural habitats. It has also been concluded that dill has various health benefits and has unique properties compared to Spirulina. The results of this study emphasize that the ecological and medicinal advantages of dill are important. Dill's broader potential for use encourages its more widespread use in various cultural cuisines and medicinal practices. As a result, it is concluded that dill should be further investigated as an alternative option to other herbal sources such as Spirulina. This could be an important step in terms of both environmental sustainability and human health.

Acknowledgment

The study aimed to provide essential information about the dill plant (*Anethum graveolens*) to a wide scientific audience, highlighting its profitability in supplying essential nutrients to the human body and enhancing soil and nature. Additionally, it explores the plant's culinary applications, such as preparing delicious meals, salads, and pickled vegetables in our cuisine.

