

The Role of Vegetable Oils as Antioxidants and Their Nutritional Components: Review

Alya Jameel Ali Alsaad¹; Sara H.M. Shareef¹; Anwaar Yasser Hussein²;
Zainab A. Ali^{1*}; Maryam Abdulbari Oraibi¹; Kafaa Hussein Ali³

1 Food Science Department, College of Basrah, University of Basrah, Iraq

2 Department of Food Science, College of Agriculture, University of Misan, Iraq

3 Directorate of seed testing and certification, Basrah, Iraq

Corresponding author: zainab.abdali@uobasrah.edu.iq

I. Abstract

The sources of vegetable oils are diverse, and because of this diversity, their uses are numerous and varied. However, the nutritional and health sectors remain the most common due to their beneficial nutritional and health benefits. Vegetable oils are considered healthy because they contain many antioxidants, including fat-soluble vitamins such as tocopherols and phenols, in addition to unsaturated and essential fatty acids, and important vitamins and minerals. They also provide the body with energy, vitality, and stamina. The importance of vegetable oils lies not only in their low saturated fatty acids and harmful cholesterol content but also in their role in protecting body cells and improving the health of the immune system, digestive system, skin, eyes, and liver. This is because most vegetable oils are rich in antioxidants and many vitamins, especially fat-soluble vitamins (A, E, D, and K). The importance of essential fatty acids lies in their crucial role in compensating for deficiencies in these essential fatty acids in the body resulting from surgery, malnutrition, or following a specific diet. Among the most important of these acids are Omega-3, 6, and 9 fatty acids play a crucial role in enhancing the function of the immune system.

This study dealt with several well-known vegetable oils, highlighting their significant medicinal and health benefits, as well as their diverse applications in various fields, including food, pharmaceuticals, cosmetics, and fitness. The study also clarified the antioxidant and essential fatty acid content of these vegetable oils, noting their importance in growth and maintaining overall health.

Keywords: *Vegetable oils, Nutrition, antioxidant, Fatty acids.*

II. Introduction

Vegetable oil is oil extracted from natural plant sources, such as sesame oil, olive oil, and sunflower oil. It is a less dense liquid than water and usually does not mix with it without the addition of intermediates, most of which are chemicals and are triglycerides of three fatty acid esters and calcirol. They are produced from the reaction between two calcerins and three similar or dissimilar types of fatty acids [1]. There are many raw materials currently used in the production of vegetable oils, which number more than two hundred types of raw materials (botanical). Annual plants are currently the largest source of oils, such as sunflowers, corn, sesame, cotton, soybeans, and peanuts, as well as perennials that produce oil-rich fruits such as coconut, palm, and olives [2].

Most of the oils and fats produced globally and suitable for human consumption are derived from plant sources. These derivatives are called vegetable oils, which play an important role in the global



economy in terms of trade volume and monetary value, as most of them are rich in antioxidants for these products in global trade [3]

Vegetable oils are industrially extracted from available and relatively inexpensive fruits, seeds, and peels to make their production and marketing economically viable. Many annual plants are one of the most important sources of vegetable oil production. [4] Recent studies have demonstrated the diversity and multiplicity of sources of vegetable oil production, and among the most important sources are: Cottonseed Peanut, Coconut Seed, Coconut Palm, Palm Groundnut (peanut) seeds, Peanut Seed, Grape seed Grape, Maize Yellow Corn Seed, Mustard seed mustard, Palm kernel, rapeseed rapeseeds, rice bran rice, sunflower seeds, soya bean, sesame seed, and safflower seeds [5].

Vegetable oils are believed to be present in all parts of oily plants, including the stem, leaves, roots, flowers, and fruits, although their concentration is higher in the fruits. Oil seeds are believed to be crops of great economic importance that occupy a prominent position in the global economy in terms of cultivated area and production volume, employing a wide range of workers in agriculture, commerce, and industry. These crops and their products are a primary source of food for human consumption, in addition to being a raw material used in various food industries, the most important of which may be the extraction and refining of oil [6]. The oils and fats extracted from the seeds of these crops are also a staple in the manufacture of margarine, butter shortening, salad oil, bread, pastries such as cakes, biscuits, sweets, snacks and mayonnaise. Mayonnaise, dressing sauces, and other products that can be classified as indispensable ingredients in home kitchens, public restaurants, and food processing plants [7].

For example, eating 100 grams of oilseeds can contribute to providing the body with an amount of energy of 600 kcal, and it is worth noting that the main source of energy in food is fat, and each gram of fat contains an amount of energy of 9 kcal, equivalent to 37 kilojoules. Oilseeds are rich in fiber and mineral elements such as phosphorus, iron Fe, and magnesium Mg. Vitamins including vitamin E, which is an antioxidant, have been classified as healthily balanced foods [8].

2-Vegetable oils

Vegetable oils are among the primary products derived from plants. These oils are found in the lipid bodies of oleaginous fruits or seeds. The quality of the raw material and the specific characteristics of the oil determine how the product can be obtained. This can be done using mechanical methods, such as cold pressing and expeller pressing, or through solvent extraction methods, which include solid-liquid extraction and supercritical fluid extraction. [9]. Vegetable oils are hydrophobic substances, meaning they are insoluble in water. They belong to the chemical class of lipids, which are the most abundant group of compounds found in nature. Lipids are primarily composed of a mixture of various chemical compounds, with fatty acids and their derivatives being the most important [10]. Vegetable oils serve as carriers for fat-soluble vitamins, providing energy and essential fatty acids crucial for the body. [11]. Oils contribute to the taste, texture, and overall palatability of many food products. Additionally, they can replace animal fat, which is derived from various plant species. The diverse range of oils makes them widely consumed and produced around the world, making them an important part of our diet. The variety and consumption of these oils depend on their availability in each country or region [12]. Figure I illustrates the global production of major oils, with palm, soybean, and rapeseed oils being the most produced.



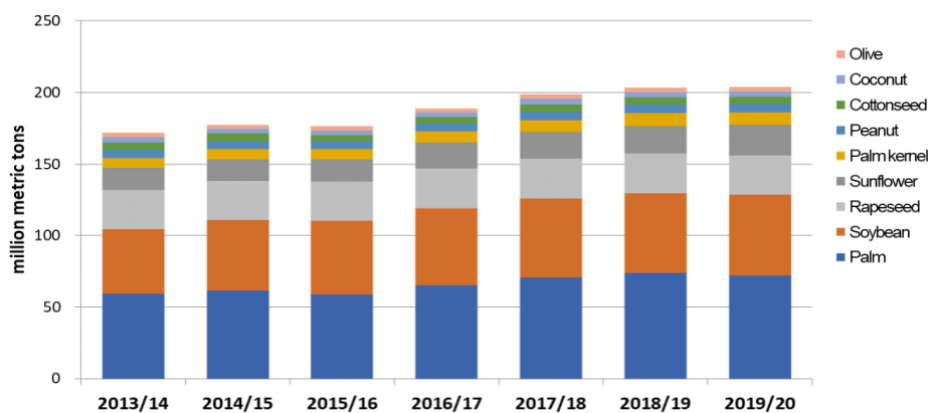


Figure I illustrates the global production of major oils [13]

3- Oil composition

Oils are primarily made up of triacylglycerols, which account for approximately 95% of their composition, along with some free fatty acids, monoacylglycerols, and diacylglycerols. Oils also contain various compounds in different proportions, such as proteins, phospholipids, free and esterified sterols, triterpene alcohols, carotenes, tocopherols, tocotrienols, chlorophylls, polyphenols, certain pigments, hydrocarbons, and trace metals [14]. Figure (2). The composition of oil worldwide depends on the origin's raw material characteristics and quality

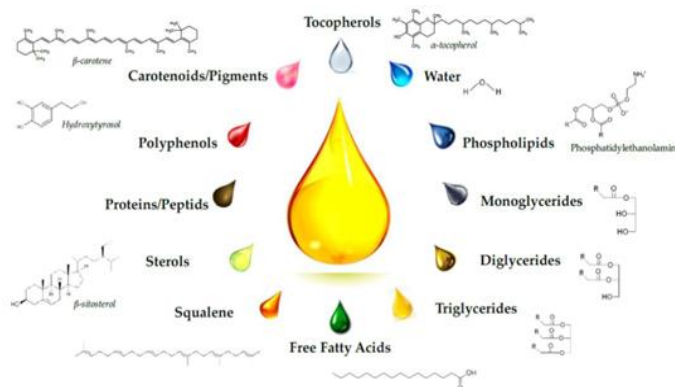


Figure (2) General composition of vegetable oils [15]

4-Vegetable oils as a source of Antioxidants

Antioxidants are compounds that can effectively reduce oxidation when added in small amounts to a target substance. They work by decreasing the generation of free radicals or stopping the spread of oxygen radicals. Using antioxidants during the processing of oils is one of the most efficient and practical methods for minimizing oxidation in fats and oils [16].

Natural antioxidants can be found in various plant sources, including grains, spices, nuts, fruits, vegetables, and vegetable oils, the components responsible for the antioxidative effects in vegetable



oils include flavonoids (such as quercetin, kaempferol, and myricetin), catechins, and phenolic compounds (like carnosol, rosmanol, and rosmaridiphenol), as well as phenolic acids (such as carnosic acid and rosmarinic acid) [17]. Tocols are another group of natural antioxidants present in plant-based oils, with α -tocopherol being the most active biological isomer. On the other hand, γ -tocopherol is recognized as the most effective antioxidant 25. Among various tocopherols, α -tocopherol is the most unstable and is easily degraded at elevated temperatures [17]. Vegetable oils such as peanut, corn, sesame, sunflower, and soybean contain high levels of polyunsaturated fatty acids, which can be rapidly decomposed during prolonged frying. In contrast, natural compounds like tocopherols, oryzanol, the sterol fraction, and squalene can enhance the stability of these oils at high temperatures [18].

Table (1) Natural antioxidants sourced from plants oil can be used in cooking to stabilize its nutritional quality [19].

| Cooking oil | Natural antioxidants (Extracted) |
|---------------|--|
| Olive oil | Tocopherols, β -carotene, lutein, squalene, lipophilic and hydrophilic phenols |
| Coconut oil | Tocopherols |
| Canola oil | Apigenin, chrysin, quercetin, myricetin, morin, kaempferol, rutin, naringenin, naringin, taxifolin |
| Avocado oil | β -carotene |
| Peanut oil | Catechins, Epicatechins |
| Sesame oil | Sesamol, sesamolin, and gamma-tocopherol |
| Sunflower oil | Olive leaf extract, Spinach extract. |
| Soyabean oil | Linolenic and oleic acid, Olive leaf extract |
| Palm oil | Cinnamom extract, Rosemary extract |
| Groundnut oil | Rosemary extract |

Numerous studies have examined the use of natural vegetable oils extracts as antioxidants. Research has demonstrated that these natural extracts exhibit greater antioxidant activity and heat resistance, which are crucial characteristics for effective antioxidants in vegetable oils [20]. For example, green tea is recognized as a potent antioxidant, showing excellent activity at concentrations of 200 ppm and above in both sunflower and soybean oils. Its antioxidant effectiveness surpasses that of BHA and BHT, though it remains lower than that of TBHQ. In a study conducted by, the thermoxidative stability of soybean oil was analyzed with rosemary extract at 3000 ppm compared to TBHQ at 50 ppm. Additionally, the processing of vegetable oils has a significant impact on their nutritional composition [21].

Vegetable oils also enrichment of fatty acids antioxidants, the human body has the ability to synthesize several fatty acids; however, there is a specific group of polyunsaturated fatty acids known as essential fatty acids that it cannot produce on its own. These essential fatty acids include omega-3 (n-3) and omega-6 (n-6) fatty acids. The precursor for the omega-3 series is alpha-linolenic acid (C18:3 n-3), in contrast, the primary fatty acid in the omega-6 series is linoleic acid (C18:2 n-6) [22]. Vegetable oils like olive oils and sunflower oils are sources of healthy polyunsaturated fatty acids that are however highly susceptible to oxidative degradation. The wide therapeutic range of n-3 polyunsaturated fatty acids (PUFAs) from plant sources is particularly significant due to its implications for managing inflammatory disorders. Recent information about the FDA's approval of omega-3 oils for formulation development highlights their adaptability and potential impact on creating novel medications. A comprehensive analysis of omega-3 PUFAs demonstrates their remarkable therapeutic potential against various diseases, as well as their essential role in a balanced diet [23]. This supports the use of n-3 PUFAs in both preventative and therapeutic strategies aimed at enhancing human health and well-being. These fatty acids play a crucial role in cellular processes such as signaling pathways, maintaining cell membrane integrity, and ensuring structural stability.

<https://iasj.rdd.edu.iq/journals/journal/issue/20226>

<https://doi.org/10.54174/utjagr.v13ii.98>

They significantly influence important physiological functions, including the nervous system, blood pressure regulation, blood cell formation (hematopoiesis), glucose metabolism, and inflammatory responses [24]. Figure 3, table 2 illustrates the structures of omega-3 and omega-6 fatty acids, Percentage of fatty acids in vegetable oils [25].

Table (2) Percentage of fatty acids in vegetable oils [25].

| Vegetable oils | Fatty acids | |
|----------------|---------------|-----------------|
| | Monosaturated | Polyunsaturated |
| Olive | 71.3 | 12.7 |
| Rapeseed (A) | 65.2 | 29.3 |
| Rapeseed | 65.0 | 29.0 |
| Sunflower (A) | 22.8 | 65.2 |
| Sunflower | 23.0 | 65.0 |
| Corn (A) | 33.5 | 51.0 |
| Corn | 34.0 | 50.0 |
| Soybean | 24.3 | 60.0 |
| Rice | 40.8 | 40.1 |

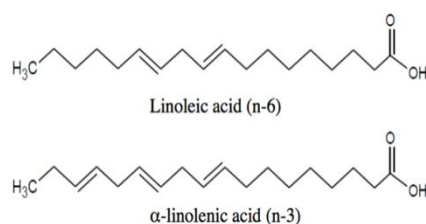


Figure (3) The structures of omega-3 and omega-6 fatty acids

5- Methods of oil extraction

The Chinese were the first to use oil thousands of years ago, and they used a special method of extracting oil that is somewhat similar to modern techniques. They would crush the seeds using grinders made of hard basalt stones, then heat the seeds in open pots, and finally press them into a wedge-shaped press made of a cone cleavage.

Some of these models still exist in Central Asia. Joseph Bromah then used a hydraulic press for the first time, a powerful piston that is still used today to extract oils from oil seeds, especially olive oil. At the end of the 19th century and the beginning of the 20th century, the method of extracting oils and fats using solvents was introduced, especially in the extraction of oils from seeds with a low oil content or in the extraction of oils left after the hydraulic pressure phase [26].

Table (3) Types and ratios of fatty acids estimated for some vegetable oils [27].

| Linolenic Acid % | Linoleic Acid % | Oleic acid % | Stearic acid % | Palmitic acid % | Oil |
|------------------|-----------------|--------------|----------------|-----------------|-------|
| 57-48 | 20-14 | 25-14 | 4-2 | 7-6 | Linen |

| | | | | | |
|---------|-------|-------|-------|-------|--------------|
| 28-16 | 69-46 | 14-7 | 3-2 | 7-4 | Prickly pear |
| 85-70 | 15-8 | 12-5 | 2-1 | 5-3 | Castor |
| 67-64 | 18-13 | 8-5 | 3-1,5 | 7-3 | Sesame |
| 0,5-1,5 | 77-72 | 20-15 | 4-2 | 10-7 | Tobacco |
| 10-5 | 58-48 | 30-19 | 6-2 | 12-7 | Soy |
| 0,5-0,1 | 70-50 | 28-15 | 6-2 | 7-5 | Sunflower |
| 0,5-0,1 | 58-54 | 20-17 | 3-1,5 | 24-20 | Cotton |

6- Some types of vegetable oils and their benefits

6-1 Olive oil

Olives are a well-known plant, which is one of the best foods, and has many medicinal benefits, most of which are found in olive oil. The oil extracted from ripe olives is yellow in color, sweet, and mild in flavor, while the oil extracted from unripe olives is green in color and tends to be acidic [28].

6-1-1 Ingredients of olive oil:

Unsaturated fats, such as omega acids, such as oleic acid, linoleic acid, and linolenic acid, are the highest percentage of oil components, as well as antioxidants such as oleocanthal, calcium, iron, sodium, vitamin K, and vitamin E (tocopherol, which is also an effective antioxidant[29].

6-1-2 Benefits:

It reduces LDL cholesterol, relieves inflammation, reduces excessive blood clotting, lowers blood pressure, which is believed to be one of the biggest risk factors for heart disease and premature death, and has an anti-inflammatory and heart-protective effect. Eating olive oil in the diet has the potential to speed up your metabolism. Because olive oil is rich in vitamin E and helps prevent hair loss, it is one of the most important benefits it offers for hair health and bone growth. Olive oil can also help older adults avoid strokes [30].

6-2 Prickly Pear Prickly Pear Seed Oil

Prickly pear seed oil is extracted from the seeds of prickly pear fruit, and is one of the most expensive oil products in the world. It is widely found in Mexico, Latin America, and the Mediterranean region [31].

6-2-1 Prickly Pear Seed Oil Ingredients:

Formulated with monounsaturated fatty acids and polyunsaturated fatty acids such as omega-6, vitamin E, and vitamin B5 [32].

6-2-2 Benefits:



Strengthens bones: The high calcium content in prickly pear oil helps to strengthen and protect the body's bones from osteoporosis and fractures. Some nutritionists suggest using prickly pear oil drops after large meals to help improve digestive health because it helps the stomach digest fat more easily. Prickly pear oil can help curb appetite for long periods, reducing daily calorie intake and aiding in weight loss [33].

Stress Relief: Prickly pear oil contains many mood-boosting and nerve-soothing nutrients, such as antioxidants and amino acids.

Anti-aging: The antioxidants in prickly pear oil help delay the onset of signs of aging. Moisturizing the skin is one of the reasons why prickly pear oil is good for skin health, which contains linoleic acid, which helps the skin retain moisture, keeping it hydrated [34]. Some research has shown that prickly pear oil is an effective natural remedy for acne, as well as contains substances that fight the bacteria responsible for this condition in the skin [35].

6-3 Helianthus annuus (sunflower seed oil)

It is called sunflower, and the third most important crop in terms of oil crops in the world. Sunflower is one of the plants in the compound family, and it is characterized by its large flowers that face towards the sun wherever it moves; hence, it is called the sunflower, and is cultivated as an ornamental plant.

Sunflower seed ingredients: It is composed of oleic acid, stearic acid, palmitic acid, linoleic acid and vitamin E [36].

6-3-1 Benefits:

There is some scientific evidence to suggest that consuming an oil rich in oleic acid in moderate amounts may reduce the likelihood of heart disease as well as reduce the level of bad cholesterol in the body, supported by oil rich in oleic acid, which helps lower the level of bad cholesterol in the body, which is a key factor in heart disease and strokes [37].

Skin care is rich in sunflower oil, which is a rich source of vitamin E, which acts as an antioxidant that protects the skin from free radicals and harmful sun rays that cause the appearance of wrinkles. It is also used as a moisturizer for dry skin and has applications in scar healing and wound healing. In addition, oleic acid-rich oil supports the body's efforts to lower LDL cholesterol levels, which is a major cause of heart disease and stroke.

Maintaining brain and nerve health. The role of vitamin E in sunflower oil is indicated in alleviating the severity of Alzheimer's disease and maintaining brain health [38].

6-4 Rosmarinus officinalis

Rosemary, also known as "sea dew" or "germinal", is a perennial woody herb that belongs to the appendix family, which includes peppermint. It has needle-like leaves, and its flowers can be white, pink, purple, or blue. Its origin is in the Mediterranean region. The origin of the name "rosemary" comes from the Latin words: "rhous", which means "sumac", and "marinus", which means "from the sea". Some of them also refer to it as "anthos", which is a word derived from the Greek meaning "flower". This plant has a fibrous root system. Rosemary contains many phytochemicals such as eucalyptus, rosmarinic acid, caffeic acid, urosolic, biotonic, and a number of antioxidants [2].

6-4-1 Benefits:



Hair Loss Treatment: I discovered that many scientific studies have shown the great effectiveness of this oil in treating alopecia areata and hereditary baldness. As a result, this oil is one of the traditional remedies in the industry because it may affect the liver and gallbladder, and it may help in the detoxification process from the body. Rosemary oil has the ability to strengthen and protect the liver from injury in general, in addition to helping it produce more bile. Among the many traditional benefits of this oil is memory enhancement. The scent of this oil may help focus attention, stimulate the brain, provide defense against when Alzheimer's disease first appears and relieve pain thanks to the anti-inflammatory properties of this oil; the use of this oil may help relieve pain in different areas of the body by massaging the area of pain. With a mixture of oils that includes drops of this oil which is helpful in increasing blood flow, however some people believe that massaging the body with rosemary oil will help to warm the body significantly. The area that is massaged with this oil experiences a slight rise in body temperature as a result of the effective help of the oil in improving and promoting blood circulation in that area. The oil is especially helpful in fighting muscle aches, inflammation, joint pain, and various types of headaches. It is one of the antioxidant-rich oils that help fight cancer and may be crucial in fighting this disease. Additional benefits include boosting the immune system, improving digestion, treating respiratory conditions, including sinus congestion, reducing sexually transmitted infections, treating depression, and reducing external symptoms of aging [39].

6-5 Sesame oil

Sesame is an oily crop that has been used as food and fat since ancient times. The oil extracted from it is high in proteins, fatty acids, and antioxidant flavonoids, which help it retain its natural properties. Sesame oil is used in cooking, and many cultures still incorporate it into their diets by adding it to their traditional dishes. Many societies also rely on it for medicinal and therapeutic purposes. In addition, it is used in the production of sweets and pastries. Sesame oil is known as "serg" or "Shirg", and in Iraq he is called "Rashi". It is often eaten with dates and is used in the preparation of chickpeas. A white or brown substance known as tahini is extracted from sesame seeds after it is squeezed, and it is one of the oils extracted from sesame seeds, and it is one of the first oils to be extracted from plants. It is often yellowish-brown in color [4].

6-5-1 Ingredients:

Sesame oil is made up of monounsaturated fats, polyunsaturated fats such as omega-3 and omega-6, saturated fats, and vitamins K, E, as well as antioxidants such as sesamol, in addition to minerals such as copper and calcium.

6-5-2 Benefits:

Because sesame oil contains unsaturated fats, especially large amounts of omega-6, which are thought to be beneficial fats that promote heart health, it protects against a number of heart diseases and reduces the risk of atherosclerosis by delaying the accumulation of fat on the walls of the arteries. This is due to sesame oil's ability to increase good cholesterol levels in the blood while reducing triglyceride and LDL cholesterol levels.

Antioxidants such as sesamol, found in sesame oil, are helpful in removing free radicals, Heart disease and cancer are just two of the chronic diseases that can result from the accumulation of these free radicals. The antioxidants in sesame oil can be beneficial by taking it as it regulates blood sugar levels,



and taking sesame oil for up to 90 days improves fasting blood sugar levels in patients with type 2 diabetes.

In addition, it helps regulate blood sugar levels in the long term, and sesame oil helps lower blood pressure levels in patients with high blood pressure. This is due to its ability to reduce levels of sodium salt, which is a cause of high blood pressure. This effect is also attributed to the presence of Trans fats, antioxidants and vitamin E., sesame oil improves bone health, prevents and combats osteoporosis with age, thanks to its copper and calcium content, and treats and relieves the symptoms of inflammation in the body, such as arthritis and associated pain, thanks to the presence of sesamol in sesame oil, which is attributed to protecting the body from inflammation. Sesame oil also relieves chronic pain in the hands and legs when applied to the site of pain, thanks to its antioxidant content and analgesic and anti-inflammatory properties [40].

6-6 Castor oil

Castor oil is a vegetable oil extracted from castor beans. It is a colorless to very pale yellow liquid that has a distinct taste and aroma. It consists of a mixture of triglycerides, with ricinoleic fatty acids accounting for about 90%, and other important ingredients such as oleic and linoleic acids. Castor oil consists of ricinoleic acid, oleic acid, linoleic acid, α linolenic acid, citric acid, palmitic acid, and dihydroxystearic acid [41].

6-6-1 Benefits:

Since it is used to clean the intestines before examinations and surgeries, castor oil is a powerful intestinal cleanser in medicine, as well as being a good liver function and increases the liver's ability to cleanse the body. Various abdominal pains and infections can be relieved by applying a compress of castor oil.

Skin Care: The ricinoleic acid in castor oil effectively prevents the growth of bacteria, viruses, yeasts, and fungi, castor oil is used as a skin cleanser as a result of which clogged sebaceous glands can cause dead skin cells, which castor oil can help get rid of from the skin. Castor oil helps dissolve oils in the face that clog pores and glands, which is why it is used to treat skin ulcers. Applying refined castor oil topically and washing it every night is a simple way to reap its health benefits [42].

Castor oil helps increase blood circulation in the scalp by stimulating blood flow to the hair follicles, which in turn improves adequate nutrition of the hair roots, proper nutrition of the hair roots will make the strands stronger and more elastic, allowing them to grow longer without breaking. In cases of alopecia areata or hair loss, increasing blood flow to the scalp can stimulate hair growth by strengthening and strengthening the hair follicles. Using castor oil regularly improves hair health, reduces hair loss, and increases hair density, adding that using castor oil once a month can stimulate hair growth at a rate of three to five times the normal rate. The antimicrobial, insecticide, and fungal properties of castor seeds, along with the ricinoleic acid found in castor oil, are useful in combating microbial and fungal infections of the scalp, such as pilonidal folliculitis and ringworm, which are the main causes of hair loss, as well as the ricinoleic acid found in castor oil. They are believed to be the main causes of hair loss [42].

6-7 Flaxseed oil

Flax is an annual or perennial plant that belongs to the flax family, and the parts used of the flax plant are oil and seeds. The flax plant reaches a height of about one meter, and has a thin stem and



leaves. Its flowers are blue, while the seeds are brown. Flax is grown from the Eastern Mediterranean to India, and is also grown in Europe.

6-7-1 Flaxseed Oil Ingredients

One of its most important components Styric and Palmitic and Arakidic, palmitoleic acid, oil or oleic acid is an omega-9 fatty acid, eicocinic acid, linoleic acid, and alpha-linolenic acid and other fatty acids [43].

6-7-2 Benefits:

Providing the body with omega-3 fatty acids, reducing inflammation and infection, increasing heart health, and keeping the brain from aging. The oil helps reduce the spread of cancer cells. Although research in this area is still in its early stages, preliminary results suggest that flaxseed oil may help slow the growth and spread of cancer cells. It improves heart health. It lowers blood pressure. It increases the elasticity of blood vessels [44].

One of the most important widely known advantages of omega-3 fatty acids, which are found in flaxseed oil, is their ability to reduce the risk of various infections and can effectively treat both diarrhea and constipation with flaxseed oil. According to a recent animal study in experimental animals, flaxseed oil can control the movements of the digestive system, which may help avoid diarrhea, as well as enhanced skin texture and health by increasing moisture and reducing skin sensitivity and irritation, as well as a reduction in the severity of accompanying symptoms such as itching, swelling, redness, and reduced inflammation thanks to the high content of omega-3 fatty acids in flaxseed oil, and this oil has been found to have the ability to reduce inflammation in general. The effect of flaxseed oil in this regard has also been found to be quite similar to that of olive oil in reducing inflammation [45].

7- Conclusion

The different sources of vegetable oils are diverse, and because of this diversity, the uses of vegetable oils have been varied in different fields, but the nutritional and health field has remained the most used because of its beneficial nutrients and health elements, as vegetable oils are considered healthy because they contain unsaturated fats and many essential fatty acids, vitamins and minerals that are important and essential for the body, and also because they provide the body with energy, activity, and the ability to endure effort.

The importance of vegetable oils lies not only in the fact that they do not contain saturated fats or bad cholesterol, but also in their importance in protecting the cells of the body, as well as in improving and developing the cells of the immune system, digestive system, skin, eyes, and liver, because vegetable oils are mostly rich in antioxidants as well as many vitamins, especially fat-soluble vitamins (A, E, D, K).

This study relied on the consumption of some types of well-known vegetable oils and their most important medical and health benefits and their multiple other uses in many fields such as various food industries, pharmaceuticals, cosmetics and fitness, as well as the study explained the content of vegetable oils of essential fatty acids and their percentages, which are of great importance in growth and maintaining the health and safety of the body.

The importance of essential fatty acids lies in the fact that they have a great role in compensating for the deficiency of these essential fatty acids in the body as a result of people undergoing surgeries, malnutrition or following a certain diet, and the most important of these acids is omega-3, which has a fundamental role in improving the function and work of the immune system within the body.



III. References

1. Darwesh AM, Sosnowski DK, Lee TY, Keshavarz-Bahaghighat H, Seubert JM. Insights into the cardioprotective properties of n-3 PUFAs against ischemic heart disease via modulation of the innate immune system. *Chem Biol Interact.* 2019; 308:20–44.
2. Guo X, Li J, Tang R, Zhang G, Zeng H, Wood RJ, Liu Z. High fat diet alters gut microbiota and the expression of paneth cell-antimicrobial peptides preceding changes of circulating inflammatory cytokines. *Mediat Inflamm.* 2017. <https://doi.org/10.1155/2017/9474896>.
1. Jurić S, Jurić M, Siddique MA, Fathi M. Vegetable oils rich in polyunsaturated fatty acids : Nanoencapsulation methods and stability enhancement. *Food Rev Intl.* 2022; 38(1):32–69.
2. Asif M. Health effects of omega-3, 6, 9 fatty acids: *Perilla frutescens* is a good example of plant oils. 2011; 11(1):51–9.
3. DiNicolantonio JJ, O’Keefe JH. Effects of dietary fats on blood lipids: a review of direct comparison trials. *Open Heart.* 2018; 5(2):e000871.
4. Amjad Khan W, Chun-Mei H, Khan N, Iqbal A, Lyu SW, Shah F. 2017. Physicochemical characteristics of emulsions during fat digestion in human stomach 271(1):G172–83.
5. Balić A, Vlašić D, Žužul K, Marinović B, Bukvić MZ. Omega-3 versus omega-6 polyunsaturated fatty acids in the prevention and treatment of inflammatory skin diseases. *Int J Mol Sci.* 741:(3)21 ;2020 .
6. Chaliha B, Saikia D, Saikia SP. Tree-borne edible oilseeds as sources of essential omega fatty acids for human health. In: *The health benefits of foods-current knowledge and further development.* IntechOpen; 2019. BoD - Books on Demand GmbH, Norderstedt, Germany. Chen J, Liu H. Nutritional indices for assessing fatty acids: a mini-review. *Int J Mol Sci* 5695:(16)21 ;2020 .
9. Bansal S, Choudhary S, Sharma M, Kumar SS, Lohan S, Bhardwaj V, Syan N, Jyoti Tea: A Native Source of Antimicrobial Agents. *Food Research International*, 20(2)87-90.
10. Fregapane, G., Guisantes-Batan, E., Ojeda-Amador, R.M., Salvador, M.D., 2020. Development of functional edible oils enriched with pistachio and walnut phenolic extracts. *Food Chem.* 310, 125917.
11. Ratusz, K., Popis, E., Ciemnińska-Żytkiewicz, H., Wroniak, M., 2016. Oxidative stability of camelina (*Camelina sativa* L.) oil using pressure differential scanning calorimetry and Rancimat method. *J. Therm. Anal. Calorim.* 126, 343–351.
12. Ratusz, K., Symoniuk, E., Wroniak, M., Rudzińska, M., 2018. Bioactive compounds, nutritional quality and oxidative stability of cold-pressed camelina (*Camelina sativa* L.) oils. *Appl. Sci.* 8, 1–17.
13. STATISTA, 2020. <https://www.statista.com/statistics/263933/production-of-vegetable-oils-worldwide-since-2000/>
14. Shahidi, F., 2005. *Bailey’s industrial oil and fat products.* John Wiley & Sons, Inc., USA.
15. Yara-Varón, E., Li, Y., Balcells, M., Canela-Garayoa, R., Fabiano-Tixier, A.S., Chemat, F., 2017. Vegetable oils as alternative solvents for green oleo-extraction, purification and formulation of food and natural products. *Molecules* 22, 1–24.



<https://iasj.rdd.edu.iq/journals/journal/issue/20226>

<https://doi.org/10.54174/utjagr.v13ii.98>

16. Zahid, Muqaddas, Samran Khalid, Sumbal Raana, Sara Amin, Hamza Javaid, Rizwan Arshad, Ayesha Jahangeer, Saeed Ahmad, and Syed Ali Hassan. Unveiling the anti-oxidative potential of fruits and vegetables waste in prolonging the shelf stability of vegetable oils. *Future Foods*. 2024;100328.

<https://DOI.org/10.1016/j.fufo.2024.100328>

17. Fadda, Angela, Sanna, Daniele, Sakar, El Hassan, Gharby, Said, Mulas, Maurizio, Medda, Silvia, Durazzo, Alessandra. Innovative and sustainable technologies to enhance the oxidative stability of vegetable oils. *Sustainability*. 2022;14(2):849. DOI: 10.3390/su14020849

18. Lozano-Castellón, Julián, Rinaldi de Alvarenga, José Fernando, Vallverdú-Queralt, Anna, Lamuela-Raventós, Rosa M. Cooking with extra-virgin olive oil: A mixture of food components to prevent oxidation and degradation. *Trends in Food Science and Technology*. 2022;123:28-36.

DOI: 10.1016/j.tifs.2022.02.022

19. Elagizi A, Lavie CJ, O'Keefe E, Marshall K, O'Keefe JH, Milani RV (2021)

An update on omega-3 polyunsaturated fatty acids and cardiovascular

health. *Nutrients* 13:204. <https://doi.org/10.3390/nu13010204>

20. Timilsena, Y.P., Vongsvivut, J., Adhikari, R., Adhikari, B., 2017. Physicochemical and thermal characteristics of Australian chia seed oil. *Food Chem*. 228, 394–402.

21. Embuscado ME. Spices and herbs: Natural Sources of Antioxidants – A Mini Review. *Journal of Functional Foods*. 2015;18:811–819.

[:https://DOI.org/10.1016/j.jff.2015.03.005](https://DOI.org/10.1016/j.jff.2015.03.005)

22. Theinel MH, Nucci MP, Alves AH, Dias OFM, Mamani JB, Garrigós MM,

Oliveira FA, Rego GNA, Valle NME, Cianciarullo G, Gamarra LF (2023) The

effects of omega-3 polyunsaturated fatty acids on breast cancer as a preventive measure or as an adjunct to conventional treatments. *Nutrients*

15:1310. <https://doi.org/10.3390/nu15061310>

23. Djuricic, I and Calder, P.C. (2021). Beneficial outcomes of omega-6 and omega-3 polyunsaturated fatty acids on human health: an update for 2021. *Nutrients* 13:2421. <https://doi.org/10.3390/nu13072421>

24. Sharif E, Yazdani Z, Najaf M, Hosseini-khah Z, Jafarpour A, Rafei A (2022)

The combined effect of fish oil containing omega-3 fatty acids and *Lactobacillus plantarum* on colorectal cancer. *Food Sci Nutr* 10:4411–4418.

<https://doi.org/10.1002/fsn3.3037>

25. Pradnya, G., Rajashree, S., Archana, P., Kanabargi, R. R., Omega-3 fatty acids: a comprehensive scientific review of their sources, functions and health benefits 2024. *Journal of Pharmaceutical Sciences* 10(1)

DOI:10.1186/s43094-024-00667-5



26. He M, Qin CX, Wang X, Ding NZ. Plant unsaturated fatty acids: biosynthesis regulation. *Front Plant Sci* ;2020390. <https://doi.org/10.3389/fpls.2020.00390>.
27. Barakat LA, Mahmoud RH. The antiatherogenic, renal protective and immunomodulatory effects of purslane, pumpkin and flax seeds on hypercholesterolemic rats. *N Am J Med Sci*. 2011; 3(9)411
28. Gouvinhas, I., Machado, N., Sobreira, C., Domínguez-Perles, R., Gomes, S., Rosa, E., & Barros, A. I. R. N. A. (2017). Critical Review on the Significance of Olive Phytochemicals in Plant Physiology and Human Health. *Molecules* (Basel, Switzerland), 22(11), 1986. <https://doi.org/10.3390/molecules22111986>.
29. Revelou, P. K., Xagoraris, M., Alexandropoulou, A., Kanakis, C. D., Papadopoulos, G. K., Pappas, C. S., & Tarantilis, P. A. (2021). Chemometric study of fatty acid composition of virgin olive oil from four widespread Greek cultivars. *Molecules*, 26(14), 4151. DOI:10.3390/molecules26144151.
30. Wongwarawipat T, Papageorgiou N, Bertias D, Siasos G, Tousoulis D. Olive Oil-related Anti-inflammatory Effects on Atherosclerosis: Potential Clinical Implications. *Endocr Metab Immune Disord Drug Targets*. 2018; 18(1):51-62. doi: 10.2174/1871530317666171116103618. PMID: 29149823.
31. Ivanova S, Marinova G, Batchvarov V. Comparison of fatty acid composition of various types of edible oils. *Bulgarian J Agr Sci*. 2016; 22(5):849–56.
32. Al-Naqeb, G., Fiori, L., Ciolli, M., & Aprea, E. (2021). Prickly pear seed oil extraction, chemical characterization and potential health benefits. *Molecules*, 26(16), 5018. DOI: 10.3390/molecules26165018.
33. Al-Naqeb, G., Fiori, L., Ciolli, M., & Aprea, E. (2021). Prickly Pear Seed Oil Extraction, Chemical Characterization and Potential Health Benefits. *Molecules*, 26(16), 5018. <https://doi.org/10.3390/molecules26165018>.
34. Imen Belhadj Slimen^{1, 2, *}, Taha Najar^{1, 2}, Manef Abderrabba² ¹Department of Animal, Food and Halieutic Resources, National Agronomic Institute of Tunisia, Mahragen City, Tunisia ²Laboratory of Materials, Molecules and Applications, Preparatory Institute for Scientific and Technical Studies, La Marsa Tunisia
35. El Mannoubi I., Barrek S., Skanji T., Casabianca H., Zarrouk H. Characterization of *Opuntia ficus indica* seed oil from Tunisia. *Chem. Nat. Compd*. 2009; 45:616. doi: 10.1007/s10600-009-9448-1.
36. Taoufik F., Zine S., El Hadek M., Idrissi Hassani L.M., Gharby S., Harhar H., Matthäus B. Oil content and main constituents of cactus seed oils *opuntia ficus indica* of different origin in Morocco. *Mediterr. J. Nutr ;Metab*. 20158:85–92. doi: 10.3233/MNM-150036.
37. Simonsen NR, Fernandez-Crehuet Navajas J, Martin-Moreno JM, Strain JJ, Huttunen JK, Martin BC, Thamm M, Kardinaal AF, van't Veer P, Kok FJ, Kohlmeier L (1998) Tissue stores of individual monounsaturated fatty acids and breast cancer: the EURAMIC study on antioxidants, myocardial infarction, and breast cancer. *Am J Clin Nutr* 68:134–141.



38. Centorame, L., Gasperini, T., Ilari, A., Del Gatto, A., & Foppa Pedretti, E. (2024). An overview of machine learning applications on plant phenotyping, with a focus on sunflower. *Agronomy*, 14(4), 719. DOI:10.3390/agronomy14040719.
39. de Macedo, L. M., Santos, É. M. D., Militão, L., Tundisi, L. L., Ataide, J. A., Souto, E. B., & Mazzola, P. G. (2020). Rosemary (*Rosmarinus officinalis* L., syn *Salvia rosmarinus* Spenn.) and its topical applications: A review. *Plants*, 9(5), 651. doi: 10.3390/plants9050651.
40. Wan, Y., Zhou, Q., Zhao, M., & Hou, T. (2023). Byproducts of sesame oil extraction: composition, function, and comprehensive utilization. *Foods*, 12(12), 2383. 10.3390/foods12122383.
41. Takashima, K., Komeda, Y., Sakurai, T., Masaki, S., Nagai, T., Matsui, S., Hagiwara, S., Takenaka, M., Nishida, N., Kashida, H., Nakaji, K., Watanabe, T., & Kudo, M. (2021). Castor oil as booster for colon capsule endoscopy preparation reduction: A prospective pilot study and patient questionnaire. *World journal of gastrointestinal pharmacology and therapeutics*, 12(4), 79–89. <https://doi.org/10.4292/wjgpt.v12.i4.79>.
42. Kesika, P., Sivamaruthi, B. S., Thangaleela, S., Bharathi, M., & Chaiyasut, C. (2023). Role and mechanisms of phytochemicals in hair growth and health. *Pharmaceuticals*, 16(2), 206. doi: 10.3390/ph16020206.
43. Nag, S., Mitra, J., & Karmakar, P. G. (2015). An overview on flax (*Linum usitatissimum* L.) and its genetic diversity. *International Journal of Agriculture, Environment and Biotechnology*, 8(4), 805-817. DOI:10.5958/2230-732X.2015.00089.3.
44. Bayat AR, Tapio I, Vilkki J, Shingfield KJ, Leskinen H. Plant oil supplements reduce methane emissions and improve milk fatty acid composition in dairy cows fed grass silage-based diets without affecting milk yield. *J Dairy Sci*. 2018; 101(2):1136–51.
45. Al-Madhagy, S., Ashmawy, N. S., Mamdouh, A., Eldahshan, O. A., & Farag, M. A. (2023). A comprehensive review of the health benefits of flaxseed oil in relation to its chemical composition and comparison with other omega-3-rich oils. *European journal of medical research*, 28(1), 240. doi.org/10.1186/s40001-023-01203-6.

