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Review Article

Incredible Use of Omega-3 Fatty Acids: A Review on Current Use and Future Prospective

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ABSTRACT

One of the most crucial elements of cells that affect many organisms' typical growth and function is Polyunsaturated Fatty Acids (PUFAs). In nutrition and well-being, omega-3 fatty acids, a crucial subtype of Polyunsaturated Fats (PUFAs), are sometimes referred to as "good fats." Alpha-Linolenic Acid (ALA), Eicosapentaenoic Acid (EPA), and Docosahexaenoic Acid (DHA) are the three main forms of Omega-3 fatty acids that are frequently present in meals and supplements. Omega-3 fatty acids may be found in both plants and animals. It has historically been utilised for topical fibrous dressings, dermatological applications, cutaneous wound healing, and infant health and development. Omega-3 fatty acids have a wide range of uses in terms of health advantages, including those for the heart, blood vessels, brain, eyes, inflammatory conditions, mental health, pregnancy and infant development, reduced inflammation, skin, cancer prevention, and weight management, among other things. Several enzymatic mechanisms are involved in the metabolism and conversion of omega-3 fatty acids in the human body, and these processes are crucial for preserving general health. There are fewer adverse effects than the number of uses, yet they are nevertheless noted since it might lead to allergy problems, excessive bleeding, and asthma. Another significant possible downside is that it may interact with the anticoagulant and statin medication classes. Therefore, utilise omega-3 fatty acids in conjunction with these two categories of medications with extreme caution. Scientists contend that, in contrast to other nutrients, omega-3s had a spike of scholarly and commercial activity ten years ago before waning. Every year, the industry is boosted by fresh research discoveries that either confirm prior findings or offer up new avenues for investigation. People will wish to profit from these advantages as global discretionary income grows, especially in Asia, thus the market will continue to expand as a result.

Keywords: Omega-3 fatty acids, Polyunsaturated fatty acids (PUFAs), Inflammation, Infant health.

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INTRODUCTION

Polyunsaturated Fatty Acids (PUFAs) are considered one of the most important components of cells that influence normal development and function of many organisms.[1] These polyunsaturated fatty acids play a crucial role in regulating cholesterol levels, facilitating the synthesis of eicosanoids, maintaining cell membrane integrity, regulating inflammation, supporting heart health, and enhancing brain activity, rather than being stored for energy. Recent research highlights the numerous health benefits associated with a diet rich in polyunsaturated fatty acids, particularly omega-3 fatty acids.[2] Omega-3 fatty acids, a pivotal subgroup of Polyunsaturated Fats (PUFAs), are commonly hailed as 'good fats' in the field of nutrition and wellness. These essential nutrients have garnered significant attention for their profound impact on health. These special fats, mostly found in foods like fatty fish, flaxseeds, and chia seeds, have gained notice for their significant influence on human health. Omega-3 fatty acids are long chains of carbon atoms with a carboxyl group at one end and a methyl group at the other. They're distinguished by a carbon-carbon double bond located three carbons away from the methyl end, often referred to as 'n-3s. A deficiency in Omega-3 fatty acids has been linked to a spectrum of health challenges, encompassing cognitive issues like reduced IQ and depression, as

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well as chronic conditions such as heart disease, arthritis, cancer, and an array of other significant health disorders.[3]

TYPES OF OMEGA-3 FATTY ACIDS

There are three primary 3 types of Omega-3 fatty acids that are commonly found in foods and supplements; Alpha-Linolenic Acid (ALA), Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA).

Alpha-Linolenic Acid (ALA)

ALA is a short-chain Omega-3 fatty acid with 18 carbons and three double bonds in their chemical structure. ALA is also known as C18:3n-3 because it has 18 carbons and 3 double bonds and is an n-3, or omega-3, fatty acid. ALA is commonly found in plant-based sources such as flaxseeds, chia seeds, walnuts, and hemp seeds etc. It is considered an essential fatty acid because the human body cannot synthesize it, so it must be obtained through the diet. Nevertheless, it participates in the regulation of a number of vital cellular processes in both plants and animals.[4] It is a crucial precursor of EPA or DHA, this conversion process is ineffective. A negligible portion of ALA is turned into EPA, and much less is transformed into DHA. ALA is simply stored or used as energy like other fats when it is not transformed to EPA or DHA, the specific placement of the initial double bond that classifies ALA as an Omega-3 fatty acid, setting it apart within the realm of dietary fats.[5]

Eicosapentaenoic Acid (EPA)

EPA is a long-chain Omega-3 fatty acid primarily found in fatty fish, such as salmon, mackerel, and sardines. It is also available in lower quantities in some algae-based supplements and certain types of seafood. It reduces triglycerides, lowers inflammation, and supports cardiovascular health by stabilizing heart rhythms and lowering blood pressure.[6] EPA contributes to brain health, improving cognitive function and mood regulation, while also promoting healthy vision. Additionally, its benefits skin health, reduces the risk of certain diseases, and can be helpful for joint health, autoimmune conditions, and pregnancy.[7] Despite its advantages, a balanced diet and consultation with a healthcare professional are recommended when considering EPA supplementation for optimal health.[8] Eicosapentaenoic acid has a chemical formula of $C_{20}H_3OO_2$ with a 20-carbon chain and five double bonds, the first double bond occurring at the third carbon from the omega (methyl) end of the molecule.[9] This structural arrangement is what classifies EPA as an omega-3 fatty acid. The number and position of these double bonds in the hydrocarbon chain are important factors that influence the physical properties and biological functions of EPA, making it an essential component of the human diet with various health benefits.[10]

Docosahexaenoic Acid (DHA)

DHA is another long-chain Omega-3 fatty acid commonly found in fatty fish like salmon, mackerel, and sardines are abundant sources of DHA, while it can also be found in algae-based supplements, fish oil supplements, and fortified foods. With 22 carbon atoms and six double bonds, it is classified as a long-chain polyunsaturated fatty acid. DHA's health benefits are manifold: it is essential for optimal brain function and development, making it crucial during pregnancy and early childhood.[11] Additionally, DHA supports eye health, maintains heart health by lowering triglycerides and blood pressure, manages inflammation in conditions like arthritis and inflammatory bowel disease, may enhance mood and reduce the risk of depression and anxiety, and is vital for fetal brain and eye development during pregnancy. Its versatility makes it a valuable nutrient for overall well-being.[12] Docosahexaenoic Acid (DHA) possesses a specific chemical composition that characterizes its unique structure and properties. Its molecular formula, $C_{22}H_{32}O_2$, signifies that it consists of 22 Carbon atoms (C_{22}), 32 Hydrogen atoms (H_{32}), and 2 Oxygen atoms (O_2). Structurally, DHA is a long-chain polyunsaturated fatty acid with a flexible carbon backbone. Beginning with a methyl (CH3) group at one end, often termed the "omega" end, it extends through a chain of 22 carbon atoms, each connected to the next by single bonds (CH_2). Six double bonds (CH=CH) are interspersed along this chain, marking positions specified by the Greek letter "omega" (Ω). In the case of DHA, the first double bond appears at the third carbon atom from the omega end.[13]

SOURCES

Animal Contain Omega-3 and plant sources contain omega-3 fatty acids are summarized in Tables 1 and 2, respectively.

Metabolism and conversion of omega-3 fatty acids

The metabolism and conversion of omega-3 fatty acids in the human body involve several enzymatic processes that are essential for maintaining overall health. The primary omega-3 fatty acids involved in these processes are Alpha-Linolenic Acid (ALA), Eicosapentaenoic Acid (EPA), and Docosahexaenoic Acid (DHA). Here's an overview of how these fatty acids are metabolized and converted (Figure 1).[40]

TRADITIONAL USES

Infant health and development

Eating 8 to 12 ounces of fish and other seafood per week while you're pregnant and nursing may benefit your baby's health. Salmon, herring, sardines, and trout are among examples. It is unclear if consuming dietary supplements containing EPA and DHA while pregnant or nursing has an impact on the health or development of the unborn child.[41] Yet, other studies suggest that taking these supplements may marginally lengthen a baby's gestation and raise the weight at delivery, both of which may

be advantageous. In breast milk, DHA is present. DHA is also included in most commercial new-born feeds.[41]

Dermatological applications

Omega-3 FA is a suitable supplement that may help individuals looking to reduce inflammatory skin disorders via diet due to its good safety profile, cheap cost, and simplicity of dosage. omega-3 FAs for systemic UV photoprotection and acne adjuvant therapy to lessen the number of inflamed lesions and the severity of the mucocutaneous side effects of isotretinoin usage are two areas of special clinical interest where supplementing may be beneficial.[42] omega-3 FA may be particularly helpful for treating psoriasis and eczema, the skin-related adverse effects of chemotherapy and retinoids, and systemic photoprotection, according to the most recent research, omega-3 FA are safe, affordable, and there is evidence that they contribute to a variety of skin problems, so they are a good option if a patient inquiries about dietary changes they may do to enhance the health of their skin.[43]

Cutaneous wound healing

Healing a wound is a physiological process that starts with the formation of granulation tissue and ends with the formation of a scar. Since omega fatty acids are part of membrane phospholipids and are involved in the inflammatory response, we looked into how omega-3, omega-6, and omega-9 fatty acids in the form of oils affected wound healing.[44] Rich in omega-3, omega-6, and omega-9 fatty acids, Linseed (LO), Evening Primrose (EPO), and Olive Oils (OO) were made into emulsions and put on the

Table 1: Animal source of omega-3.

		Amount of Omega-Fatty acid		
Sl. No.	Species	EPA	DHA	References
1	Herring (*Clupea harengus*)	8.5	8.3	14
2	Atlantic salmon (*Salmo salar*)	6.2	5.8	15
3	Surf smelt (*Hypomesus pretiosus*)	3.6	5.7	16
4	Capelin (*Mallotus villosus*)	3.6	4.6	17
5	Horse mackerel (*Trachurus trachurus*)	1.6	5.8	18
6	Red porgy (*Pagrus pagrus*) cultured	2.3	4.0	19
7	Arctic charr (*Salvelinus alpinus*)	1.3	2.8	20
8	Sockeye salmon (*Oncorhynchus nerka*)	0.7	1.9	21
9	Cod (*Gadus morhua*)	0.6	1.5	22
10	Red porgy (*Pagrus pagrus*) wild	0.2	1.6	23

Table 2: Plant source of Omega-3.

Sl. No.	Source (100 g edible quantity, raw)	Quantity in gram	References
1	Nuts and seeds Almonds	0.4	24
2	Chia seeds (dried)	3.9	25
3	Butternuts (dried)	8.7	26
4	Flax seed	22.8	27
5	Soybean kernels (roasted or toasted)	1.5	28
6	Walnuts black	3.3	29
7	Vegetables Beans	6.8	30
8	Broccoli	0.3	31
9	Cauliflower, Lettuce, Spinach (raw)	0.1	32
10	Radish seeds	0.4	33
11	Purslane	0.7	34
12	Soybeans(reddish)	0.7	35
13	Green (raw) Soybeans	3.2	36
14	Avocado fruit	2.1	37
15	Raspberry	0.1	38
16	Strawberry	0.1	39

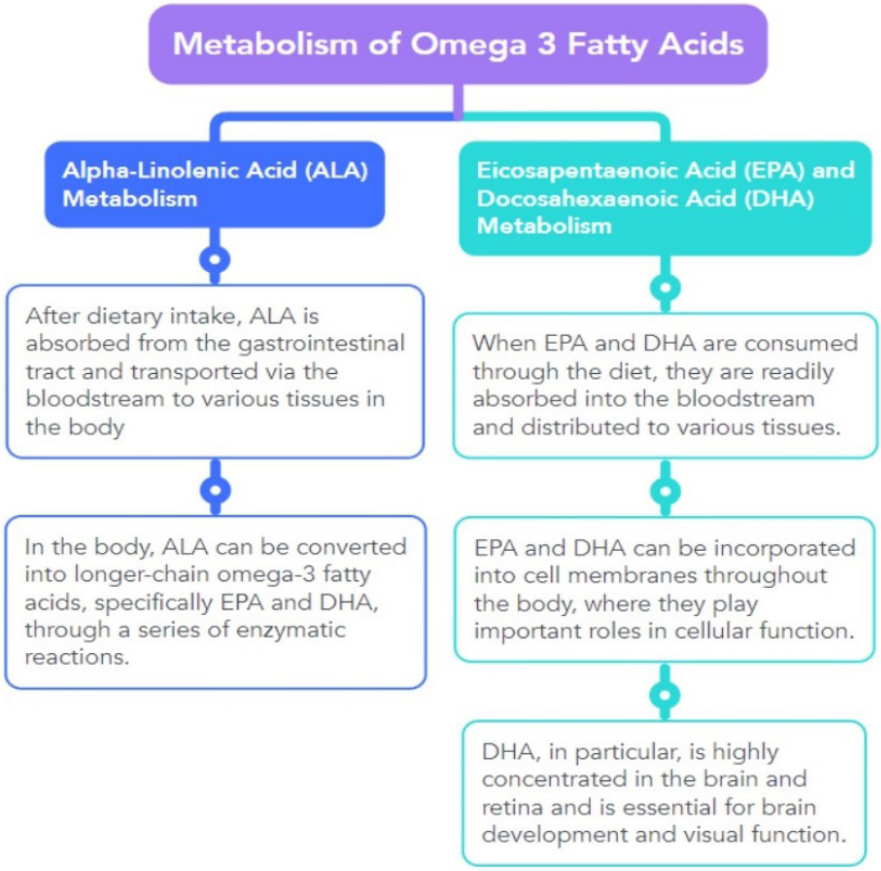

Figure 1: Metabolisms of Omega-3 Fatty Acids.

wounds of rats that had their tails cut off. All omega-3, omega-6, and omega-9-rich oils were found to help wounds heal faster than when they weren't treated. Masson trichrome staining and the hydroxyproline content assay showed that EPO caused early collagen deposition. Vascular Endothelial Growth Factor (VEGF) showed that the EPO-treated group made more new microvasculature, while the LO and OO groups only made slight improvements. During the early stage of healing, EPO increased the expression of both proinflammatory cytokines and growth factors. During the later stage of healing, this expression went down. LO changes the cytokines and chemokines that cause inflammation, but it doesn't change the growth factors. On the other hand, OO made growth factors come out instead of cytokines that cause inflammation. It seems that LO, EPO, and OO emulsions all help wounds heal, but in different ways.[45]

Topical Fibrous Dressings

Multifunctional topical approaches that supply bioactive substances that may hasten the healing of herpes blisters as well as antiviral treatment efficacy. To our knowledge, this study is the first to offer nanocomposite fibrous matrices as orofacial herpes dressings. Our fibres provide a mix of bioactive components that no other research has ever suggested. The discovered loaded fibrous matrices might be used topically to fill a significant gap in commercially available topical formulations, such as exacting therapy regimens, poor patient compliance, and very high antiviral medication dosages. Essential for quicker healing; (ii) greater patient compliance and control of the therapeutic doses; and (iii) sustained drug release, allowing a continuous treatment for at least 24 hr with a dose that ensures efficacy in arresting virus replication 27 folds greater than the highest IC_{50} reported).[46]

TOPICAL USES

Topical use for dry eye treatment

The expression of major histocompatibility complex Class II, corneal IL-1 and Tumour Necrosis Factor (TNF) as well as conjunctival IL-1, TNF-, interferon, IL-2, IL-6, and IL-10 was all considerably elevated by dry eye induction. As compared to the vehicle and untreated controls, ALA treatment considerably reduced corneal fluorescein staining. Moreover, the number of CD11b+ cells, corneal IL-1 and TNF expression, and conjunctival TNF expression were significantly decreased after ALA therapy. The use of topical ALA significantly reduced the symptoms of dry eyes and inflammatory alterations at the cellular and molecular levels. Using ALA omega-3 fatty acids topically might be a potential therapeutic for the dry eye syndrome's clinical symptoms and inflammatory alterations.[47]

Psoriasis treatment

Psoriasis is a persistent skin condition that manifests itself as breakouts. Nowadays, psoriasis is thought to be an immunologically based condition that combines secondary epidermal hyperplasia with cutaneous inflammation. Those who have been diagnosed with psoriasis are more likely to have metabolic conditions such diabetes, hypertension, obesity, and hyperlipidaemia.[48] they also smoke more often, which increases their risk of morbidity and death. Omega-3 fatty acid supplementation supports topical psoriasis therapy and significantly lowers PASI and NAPSI while increasing DLQI. It also lessens itch, erythema, scaling, and infiltration in the treated regions as well as reduces scalp. Use of n-3 PUFAs in psoriasis patients has yet to be definitively linked to reductions in psoriasis severity and other outcomes.[48]

Autoimmune, Inflammatory, and Cancerous Skin Diseases

Due to their biologically advantageous characteristics, Resveratrol (RSV) and omega-3 have drawn attention from researchers in the dermocosmetic and pharmaceutical sectors; nevertheless, these bioactive have technical challenges that prevent efficient delivery to the target skin layer.[49]

Prevention of non-melanoma skin cancer

In a study it was found that after 3 months of supplementation with 4 g of v-3 FA per day, it has been shown that cutaneous v-3 FA composition improves eight-fold and PGE2 levels are dramatically decreased in 230 people. The v-6/v-3 FA ratio of the red blood cell membrane, which can be regularly seen, is a simple to measure characteristic that may be used to gauge these reactions.[50] Also, it is important to regularly examine your diet's v-6/v-3 fatty acid consumption since a rise in v-6 fatty acids can counteract any positive effects v-3 fatty acids may have.[50] Photo-protective macronutrients-Omega-3 Polyunsaturated Fatty Acids (*n*-3 PUFA), a macronutrient, may alleviate sunburn, cancer, photosensitivity, and photoaging induced by solar Ultraviolet Radiation (UVR). Sunlight damages skin, yet lifestyle changes have increased solar exposure. Topical sunscreens alone cannot prevent excessive UVR exposure, which increases skin cancer rates annually. [49] Novel photoprotection techniques are being investigated as interest in systemic photoprotection using naturally available nutrients grows. Many routes protect the skin from UVR injury, making omega-3 Polyunsaturated Fatty Acids (n-3 PUFA) promising options. This review discusses the biological effects of *n*-3 PUFA on skin protection against acute and chronic UVR overexposure and how cutting-edge technologies like lipidomics and nutrigenomics help us understand how these nutrients influence skin health.[50]

On skin

An innovative idea is the use of nutrients like omega-3 Polyunsaturated Fatty Acids (*n*-3 PUFAs) to promote healthy skin and cure skin conditions. Due to their superior safety profile, these bioactive fatty acids could be utilised in addition to or instead of conventional treatment. There is evidence to support a variety of processes by which *n*-3 PUFA exercise their protective effects in biological tissues.[48]

Current uses of omega-3 fatty acids

Omega-3s fatty acids are not just any fats. They're the building blocks for hormones that manage inflammation, artery function, and blood clotting. They also influence genetic activity through cell receptors. These mighty fats are known to prevent heart disease and stroke, aid in conditions like lupus and rheumatoid arthritis, and potentially shield against cancer and other diseases. It's likely these unique qualities that make omega-3s a health superstar.[51] In the current era, omega-3 fatty acids stand at the forefront of health and well-being, influencing a wide array of essential functions and applications are given below:

Cardiovascular Health

Omega-3 fatty acids offer several crucial benefits for cardiovascular health. Here are some of their primary uses in promoting heart health: Reducing Triglycerides: Omega-3 fatty acids reduce triglycerides by inhibiting liver VLDL production, increasing triglyceride clearance, modulating gene expression, competing with omega-6 fatty acids, and reducing inflammation. Lowering Blood Pressure: Omega-3 fatty acids lower blood pressure by promoting vasodilation, reducing inflammation, inhibiting angiotensin, and decreasing sympathetic nervous system activity. Preventing Blood Clots: Omega-3 fatty acids reduce blood clot formation by decreasing platelet aggregation and promoting blood vessel dilation. Anti-Arrhythmic Effects: Omega-3 fatty acids have anti-arrhythmic effects by stabilizing cell membranes in heart cells and reducing abnormal electrical activity.[52]

Brain Health

Omega-3 fatty acids, particularly Docosahexaenoic Acid (DHA), play a crucial role in brain health. They are essential components of cell membranes in the brain and have several mechanisms that contribute to their benefits: *Neuroprotection*: Omega-3 fatty acids help protect brain cells from oxidative stress and inflammation, reducing the risk of neurodegenerative diseases.[42] *Enhanced Neuroplasticity*: They support synaptic plasticity, aiding in learning and memory functions. *Anti-Inflammatory*: Omega-3s have anti-inflammatory properties that can reduce neuroinflammation, which is implicated in various brain disorders.[43] *Improved Cerebral Blood Flow*: They may enhance blood flow in brain regions, supporting cognitive function.[53]

Eye Health

Omega-3 fatty acids, particularly Docosahexaenoic Acid (DHA), can be beneficial for eye health. Here's how they contribute to maintaining good vision and eye health.

Retinal Health

DHA is a major component of the retina, the light-sensitive tissue in the back of the eye.[54] Adequate DHA intake supports retinal structure and function, helping to maintain clear vision.

Dry Eye Relief

Omega-3s may alleviate symptoms of dry eye syndrome by reducing inflammation in the eye's tear glands and improving tear quality. *Protection against Age*-Related Macular Degeneration (AMD): Some studies suggest that a diet rich in omega-3 fatty acids may lower the risk of AMD, a leading cause of vision loss in older adults.[54]

Inflammatory Conditions

Omega-3 fatty acids are known for their anti-inflammatory properties and can be beneficial for various inflammatory conditions. Here's how they work:

Reducing Inflammation

Omega-3s, especially Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA), can help reduce the production of inflammatory molecules called cytokines. This can alleviate symptoms and inflammation associated with conditions like rheumatoid arthritis, Inflammatory Bowel Disease (IBD), and psoriasis.[44]

Joint Health

Omega-3s may reduce joint pain and stiffness in conditions like rheumatoid arthritis and osteoarthritis by decreasing inflammation in the joints.

Heart Health

Chronic inflammation is a risk factor for cardiovascular disease. Omega-3s can lower inflammation markers in the body, contributing to heart health.[45] *Inflammatory Skin Conditions.*

Omega-3s may help improve symptoms in conditions like eczema and psoriasis by reducing skin inflammation.[55]

Mental Health

Omega-3 fatty acids, particularly EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), can have a positive impact on mental health in several ways:

Mood Regulation

Omega-3s play a role in regulating mood and may help alleviate symptoms of depression.[56] They can enhance the production of neurotransmitters like serotonin, which are associated with feelings of well-being.

Reduced Anxiety

Omega-3s may help reduce symptoms of anxiety disorders. They can modulate the body's stress response and have a calming effect on the nervous system.[56] Omega-3s support cognitive function and are essential for brain development. Adequate intake is associated with improved memory, attention, and learning.[56]

Pregnancy and Infant Development

Omega-3 fatty acids, particularly Docosahexaenoic Acid (DHA), are crucial during pregnancy and infant development for several reasons:

Fetal Brain and Eye Development

DHA is a major component of the brain and retina. Adequate maternal intake during pregnancy supports the development of the baby's brain and visual system. [41]

Cognitive Function

DHA continues to be important during infancy and early childhood for cognitive development, including learning and memory.

Reducing Preterm Birth Risks

Omega-3 supplementation during pregnancy may help reduce the risk of preterm birth and low birth weight, promoting healthier infant development.

Supporting a Healthy Pregnancy

Omega-3s can help reduce inflammation and lower the risk of certain pregnancy complications, such as preeclampsia.[57]

Athletic Performance

Omega-3 fatty acids can potentially benefit athletic performance in several ways:

Reduced Inflammation

Omega-3s have anti-inflammatory properties, which can help athletes recover from intense workouts and reduce exercise-induced muscle soreness.

Joint Health

Omega-3s may support joint health by reducing inflammation in the joints, potentially improving overall mobility and reducing the risk of injuries.

Cardiovascular Health

A healthy cardiovascular system is crucial for endurance athletes. Omega-3s can contribute to heart health by promoting healthy blood vessel function and reducing the risk of cardiovascular issues.

Cognitive Function

Omega-3s support cognitive function, which is essential for sports that require focus, decision-making, and strategy.

Muscle Protein Synthesis

Some research suggests that omega-3s may enhance muscle protein synthesis, potentially aiding in muscle recovery and growth.[58]

Skin Health

Omega-3 fatty acids can benefit skin health in several ways: help to maintain the skin's natural moisture barrier, preventing dryness and improving overall skin hydration. Omega-3s have anti-inflammatory properties, which can alleviate symptoms of inflammatory skin conditions like eczema and psoriasis.[42] Some studies suggest that omega-3s may provide a degree of protection against the harmful effects of UV radiation from the sun, although they should not replace sunscreen. It may promote wound healing by reducing inflammation and enhancing the skin's natural repair processes and it can help to maintain skin elasticity and reduce the appearance of fine lines and wrinkles.[48]

Cancer Prevention

Omega-3 fatty acids, particularly Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA), have been studied for their potential role in cancer prevention, though the evidence is not conclusive. Some research suggests that omega-3 fatty acids may play a role in cancer prevention: Omega-3s have anti-inflammatory properties, and chronic inflammation is linked to an increased risk of cancer. By reducing inflammation, omega-3s may help lower the risk of certain types of cancer. It may influence cell signalling pathways and gene expression related to cancer cell growth and proliferation.[49] It may promote apoptosis (programmed cell death) in cancer cells, preventing their uncontrolled growth. Some studies suggest that omega-3s may inhibit the formation of new blood vessels in tumors, potentially limiting their growth and spread. Omega-3s may support the immune system's ability to recognize and eliminate cancer cells.[58]

Weight Management

Omega-3 fatty acids may have a role in weight management, although their impact is typically modest and not a standalone solution for weight loss. Here's how they can potentially contribute: Omega-3s may help regulate appetite by influencing the production of hormones that control hunger and fullness.[58] They may promote a feeling of satiety, which can potentially reduce calorie intake. It may enhance the body's ability to burn fat for energy, potentially increasing the rate of fat metabolism. During weight loss, preserving lean muscle mass is important. Omega-3s may help maintain muscle tissue while losing fat.[58]

SIDE EFFECTS OF OMEGA-3

Omega-3 (n-3) fatty acids cause asthma: Children's asthma is one of the main causes of morbidity and a significant public health issue in Australia. Environmental and historical data imply that dietary variables could be responsible for the recent rises in the prevalence of asthma and eliminating all fish from the diet is the cornerstone of fish allergy treatment.[59]

OMEGA-3 FATTY ACIDS INTERACTION WITH OTHER DRUGS

Interaction of omega-3 fatty acids with Statin group's drug: When physicians and pharmacists prescribe omega-3 and statins together, they need to determine whether the patient clinically requires the combination of both drugs. Finally, statins favor the metabolism of omega-6 fatty acids (*n*-6), which in turn inhibits n-3, they increase insulin resistance and the risk of diabetes. Thus, *n*-3 and statins are counteractive at several levels and statins appear to inhibit *n*-3. Potential drug interactions with oral anticoagulants among atrial fibrillation patients: From all high-risk non-valvular atrial fibrillation patients almost half of patients, 47.7%, had a potentially moderate or major DDI. For warfarin the most common potential DDI were found with omega-3 supplements (20.8%), amiodarone (16.7%), for dabigatran with PPI (26.1%), amiodarone (17.4%), for rivaroxaban with amiodarone (29.2%) and omega-3 supplements (16.7%). Identification of these potential DDI should raise health-care professional awareness of choosing the most suitable drug regime per persons with Afib, avoiding potentially harmful DDI.[60]

FUTURE PROSPECTIVE OF OMEGA-3 FATTY ACIDS

A small percentage of fish oil production is used in supplements, but a large amount is unsuitable.[5] Researchers anticipate change. Increased production and processing and recovery technologies will improve fish oil availability for human use. There will be new sources available in the future that are more environmentally responsible and sustainable, such the well-known algae oils. Researchers are certain that transgenic crops will provide a great low-cost source of omega-3s in the future, despite regulatory worries. With various governmental constraints, these crops will be used in various countries. ISSFAL is an international academic society that represents the majority of researchers in lipids, health, and nutrition. Omega-3 fatty acids are polyunsaturated, and three types are involved in human physiology (Figure 1): Alpha-Linolenic Acid (ALA), which is found in plant oils, Eicosapentaenoic Acid (EPA), and Docosahexaenoic Acid (DHA), which are both located in marine oils and are the primary source of omega-3s in the diet.[40] As per research, it is believed that more authorized health claims for omega-3s will be seen in the future, but it will take time as the regulatory climate develops. Not only in Europe, but throughout the world, it differs

from place to region. Claims aren't always solely based on their research, and how that science is interpreted can vary. Getting these claims authorized is a long and challenging process. It is even believed that we will see an increase in the number of pure pharmaceutical applications approved over the next five to ten years. The pharma companies are heavily involved in research in this field, looking into omega-3s as first-line or adjuvant therapies across many therapeutic areas. Over the last two decades, the omega-3 category has exploded in popularity. The market is worth an estimated $1.3 billion at the ingredient level and is growing globally. Researchers claim that this is due to the items' solid and well-established science. After many years of research, there are now several well-established claims for these products, and the science is not only well-established, but it is also evolving. Scientists argues that, unlike other nutrients, omega-3s saw a burst of scientific and academic activity 10 years ago, as well as a surge in commercial items before fading away. The research advances and new findings emerge every year, providing a boost to the market-perhaps by reinforcing the evidence in one area or opening up a new one. As global expendable income rises, people will want to take advantage of these benefits, particularly in Asia; thus, as it is predicted, the market will continue to develop. With few exceptions, omega-3 insufficiency is a worldwide issue. A few well-studied, well-known tiny populations worldwide consume a lot of dietary fish and have very high omega-3 indices. They are, however, in the minority. We're seeing their levels drop as their diets alter and adopt a more Western diet. In the future, there will be new sources accessible that are more sustainable and have higher environmental credentials, such as algae oils, which are now well established. Despite regulatory concerns, researchers believes that modified crops will be an excellent low-cost supply of omega-3s in the future. These crops will play a role in different nations with varied regulatory restrictions. Healthy nutrition: The importance of omega-3 polyunsaturated fatty acids (Omega-3 PUFA) for human nutrition and health has been established. There are very little Omega-3 PUFA produced by the human body and omega-3 PUFA is often obtained from marine sources. Unfortunately, the demand for Omega-3 PUFA for human food and aquaculture is outstripped by conventional sources because to global population expansion and consumer awareness of proper nutrition, which is why they are no longer sufficient. The use of microalgae grown under heterotrophic conditions to produce Omega-3 PUFA is becoming more widely accepted. The biggest obstacle to developing economically viable manufacturing procedures is the high expense of employing glucose as the primary carbon source for growing. The most recent relevant research provides additional routes for Omega-3 PUFA synthesis. According to early findings, using Volatile Fatty Acids (VFA) collected from waste streams as a carbon source for microalgae culture might be a suitable substitute for using glucose. Preventing gastrointestinal cancers: Significant decreases in gastric carcinogenesis, colon cancer, biliary cancer, and pancreatic cancer were seen in mice carrying the Fat-1 transgene that produced n-3 PUFAs, providing evidence of considerable reductions in gastrointestinal tumorigenesis. N-3 PUFAs have been shown to prevent cancer in several trials, however there is still a lack of evidence-based medicine in the areas of molecular pathology, epidemiology, and clinical success. The primary lack of Eicosapentaenoic and Docosahexaenoic acids in Western diets may explain the increased risk of developing cancer and the significance of the n-3/n-6 PUFA ratio in lowering cancer risk.[52] The increased rate of lipid/cholesterol production in malignant tissues makes altering the composition of cell membranes during carcinogenesis especially significant and here, we talk about how adding *n*-3 PUFAs directly to cell membranes might reverse aberrant cellular growth and reduce cancer-causing inflammation. The benefits of n-3 PUFAs as a source of fat in preventing gastrointestinal malignancies serve as an example of this.[60]

CONCLUSION

On behalf of above fact, we came into conclusion that Omega-3 fatty acids have tremendous health benefits. However, there are certain conditions where physician recommended using with precaution. It is clear that in future Omega-3 fatty acids may be use more as nutritional supplements and definitely increase its demand increase as economic status of the people increases and aware about their health. Therefore, increase demand may lead to search new way to fulfil demand of omega 3-fatty acids which probably useful for the healthcare system.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

ALA: Alpha-Linolenic Acid; **EPA:** Eicosapentaenoic Acid; **DHA:** Docosahexaenoic Acid; **LO:** Linseed oil; **EPO:** Evening primrose; **OO:** Olive oils; **UV:** Ultraviolet-visible; **PUFAs:** Polyunsaturated fatty acids; **VEGF:** Vascular endothelial growth factor; **IC_{50}:** Half-maximal inhibitory concentration; **PASI:** Psoriasis Area Severity Index; **NAPSI:** Nail Psoriasis Area Severity Index; **DLQI:** Dermatology Life Quality Index; **PGE2:** Prostaglandin E2; **FA:**

Fatty Acids; **VLDL:** Very Low Density Lipoprotein; **ω:** Omega; **g:** Gram.

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