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Review Article

Review Article On Omega 3 Fatty Acid

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ABSTRACT

Omega-3 fatty acids are essential polyunsaturated fats that play a crucial role in human health, influencing various biological processes and aiding in the management of conditions such as dyslipidemia, atherosclerosis, hypertension, diabetes, obesity, inflammatory diseases, and eye disorders. A deficiency in omega-3s can lead to mood disturbances and skin issues like dermatitis. During pregnancy, adequate intake of omega-3 fatty acids is linked to a lower risk of premature birth and enhanced intellectual development in the fetus.Rich sources of omega-3 fatty acids include fatty fish like salmon and tuna, fish oils, and certain vegetable oils. To reap the health benefits, adults are advised to consume at least two portions of fish weekly. Key omega-3 fatty acids include eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), both of which are abundant in fish and fish oil supplements.

INTRODUCTION

Omega-3 fatty acids (EFAs) are crucial for human nutrition and have garnered significant research interest over the past two decades due to their health benefits. Deficiencies in omega-3s can lead to various health issues. Studies highlight their positive effects on cardiovascular health, dyslipidemia, atherosclerosis, hypertension, diabetes, obesity, inflammatory diseases, neurological disorders, renal disease, osteoporosis, eye conditions, and pregnancy .Omega-3 fatty acids have anti-inflammatory, antiarrhythmic, and anti-thrombotic properties. Modern diets, which often include high levels of omega-6 fatty acids from vegetable oils and grain-fed meats, have shifted the omega-6 to omega-3 ratio from an estimated 1:1 in early human diets to about 10:1 today. Key sources of omega-3s include fish and fish oil (rich in eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)), as well as alpha-linolenic acid (ALA) found in seeds, nuts, green leafy vegetables, and beans.

1. TYPE OF OMEGA-3 FATTY ACIDS: three main type

2. 1. ALA (alpha-linolenic acid):

Alpha-linolenic acid (ALA) is the most common omega-3 fatty acid found in the diet, primarily

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sourced from plant foods. It serves as a precursor to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), but humans convert ALA to EPA and DHA inefficiently, with only a small percentage being transformed. When not converted, ALA is stored or used for energy like other fats.

2. EPA (eicosapentaenoic acid):

Eicosapentaenoic acid (EPA) helps your body produce eicosanoids, which are signaling molecules that play vital roles in reducing inflammation. Chronic low-level inflammation is linked to many common diseases. Research suggests that fish oil, rich in EPA and DHA, may alleviate symptoms of depression, with some evidence indicating that EPA is more effective than DHA. Additionally, a study found that EPA reduced hot flashes in menopausal women. EPA is primarily found in fatty fish like herring, salmon, eel, shrimp, and sturgeon, and it can also be found in grass-fed animal products such as dairy and meat.

3. DHA (docosahexaenoic acid):

Docosahexaenoic acid (DHA) is crucial for the structure of your skin and the retinas in your eyes. Adding DHA to baby formula can improve infants' vision, and it's essential for brain development and function throughout life. A lack of DHA in early life may lead to issues like learning disabilities and ADHD, while lower DHA levels in older adults are linked to impaired brain function and an increased risk of Alzheimer's disease. DHA may also benefit conditions like arthritis, high blood pressure, type 2 diabetes, and some cancers, and it supports heart health by reducing blood triglycerides and potentially lowering LDL (bad) cholesterol. DHA is primarily found in fatty fish, seafood, algae, and some grass-fed animal products.

Chemistry of Omega-3 Fatty Acids:

Omega-3 fatty acids, called n-3 fatty acids or ω−3 fatty acids (n-3 FAs), are a heterogeneous group of fatty acids with a double bond between the third and fourth carbon atoms from the methyl end (from the ω−1 carbon atom). In general, we distinguish among them monounsaturated fatty acids (MUFAs; one double bond in carbon chain) and polyunsaturated fatty acids (PUFAs; more than one double bond in carbon chain). Conjugated fatty acids (CFAs) are a subset of PUFAs with at least one pair of conjugated double bonds, i.e., the double bonds are not separated by methylene bridges, but one single bond an omega−3 fatty acid is a fatty acid with multiple double bonds, where the first double bond is between the third and fourth carbon atoms from the end of the carbon atom chain. "Short-chain" omega−3 fatty acids have a chain of 18 carbon atoms or less, while "long-chain" omega−3 fatty acids have a chain of 20 or more.

Sources of omega-3 fatty acids:

Current sources of omega-3 fatty acids include fish, algae, krill, and some plants. Coldwater fish are the primary sources of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), while fish obtain these from their diet or by converting some alpha-linolenic acid (ALA) from krill and algae. Some plants, like canola, soy, and flaxseed, provide ALA, but they contain little to no EPA and DHA.The conversion of ALA to EPA and DHA is inefficient in humans, leading to limited evidence that higher ALA intake significantly reduces the risk of heart disease and stroke compared to EPA and DHA. Therefore, relying on plant sources like flaxseed is unlikely to have a meaningful impact on cardiovascular health and the associated benefits of the longer-chain omega-3s.

THESE ARE THE MAIN SOURCES OF OMEGA-3 FATTY ACIDS:

1. Plant sources
2. Animal sources

1. **Plant source of omega-3 fatty acid:.**

Omega-3 fatty acids are essential fats with numerous health benefits, including reducing inflammation, lowering blood triglycerides, and potentially decreasing the risk of dementia. The primary sources of omega-3s are fish oil and fatty fish like salmon, trout, and tuna, which can pose a challenge for vegans, vegetarians, or those who dislike fish.Most plant foods provide only alpha-linolenic acid (ALA), which is less active in the body. ALA must be converted into eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) to offer similar health benefits, but this conversion is inefficient—only about 5% of ALA is converted to EPA and less than 0.5% to DHA. Therefore, if you don't consume fish or take fish oil supplements, it's essential to include plenty of ALA-rich foods in your diet to meet your omega-3 needs.

2. ANIMAL SOURCE OF OMEGA-3 FATTY ACID

FISH:

The most widely available dietary source of EPA and DHA is oily fish, such as salmon, herring, mackerel, anchovies, and sardines. Oils from these fishes have around seven times as much omega−3 as omega−6. Other oily fish, such as tuna, also contain n−3 in somewhat lesser amounts. Although fish are a dietary source of omega−3 fatty acids, fish do not synthesize omega−3 fatty acids, but rather obtain them via their food supply, including algae or plankton.

Approximate EPA Plus DHA Content in Fish and Amount of Fish Required to Provide 1 g of EPA plus DHA

Type of fish	EPA plus DHA content, g per 3-oz serving of fish (edible portion)	Amount of fish (oz) required to provide approximately 1 g of EPA plus DHA per day*
Catfish		
Farmed	0.15	20.0
Wild	0.20	15.0
Crab, Alaskan King	0.35	8.5
Flounder/sole	0.42	7.0
Haddock	0.20	15.0
Halibut	0.40 to 1.00	3.0 to 7.5
Herring		
Atlantic	1.71	2.0
Pacific	1.81	1.5
Mackerel	0.34 to 1.57	2.0 to 8.5
Salmon		
Atlantic, farmed	1.09 to 1.83	1.5 to 2.5
Atlantic, wild	0.90 to 1.56	2.0 to 3.5
Chinook	1.48	2.0
Sockeye	0.68	4.5
Sardines	0.98 to 1.70	2.0 to 3.0
Shrimp, mixed species	0.27	11.0
Tuna		
Fresh	0.24 to 1.28	2.5 to 12.0
White, canned in water, drained	0.73	4.0

EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid.

**—The intakes of fish given are very rough estimates because oil content can vary markedly (more than 300 percent) with species, season, diet, and packaging and cooking methods.*

Meat:

Omega−3 fatty acids are formed in the chloroplasts of green leaves and algae. While seaweeds and algae are the sources of omega−3 fatty acids present in fish, grass is the source of omega−3 fatty acids present in grass-fed animals. When cattle are taken off omega−3 fatty acid-rich grass and shipped to a feedlot to be fattened on omega−3 fatty acid deficient grain, they begin losing their store of this beneficial fat. Each day that an animal spends in the feedlot, the amount of omega−3 fatty acids in its meat is diminished.

Eggs:

Eggs produced by hens fed a diet of greens and insects contain higher levels of omega−3 fatty acids than those produced by chickens fed corn or soybeans. In addition to feeding chickens insects and greens, fish oils may be added to their diets to increase the omega−3 fatty acid concentrations in eggs.

Signs and Symptoms of Omega-3 Deficiency

Major health issues might result from omega-3 deficiency. Certain eating regimens and diets might increase susceptibility to this deficit. For instance, fatty acid levels may become excessively low if a person consumes a lot of red meat and poultry or severely restricts their fat intake. While certain omega 3 deficiency symptoms may not be clear to the patient, the following more obvious omega-3 fatty acid deficiency symptoms call for a test of the patient's omega-3 levels:

Dryness and itchiness of the skin:

One of the first areas of the body where one may notice an omega-3 fat deficiency is in the skin. Some people experience sensitive, dry skin, or even an unexpected rise in acne. In some people, having more acne than usual may be a subtle sign of an omega-3 deficit. Omega-3 fats strengthen the skin's protective layers in order to stop moisture loss and shield the skin from irritants that might cause dryness and irritation

Depression:

Omega-3 fatty acids are recognized to have neuroprotective and anti-inflammatory properties, making them a crucial component for brain health. They Numerous studies demonstrate an association between low omega-3 levels and an increased risk of depression. While several factors can contribute to mental health illnesses, a diet rich in omega-3 fatty acids may help reduce the risk of multiple mental health problems

Dry Eyes:

The advantages of omega-3 fatty acids for the eyes include potential relief from the signs of dry eyes. Maintaining ocular moisture and supporting tear formation are two functions of omega-3 fats in sustaining eye health. Common signs of omega-3 deficiency in the eyes include eye pain and visual

problems. For this reason, many medical professionals recommend omega-3 dietary supplements to treat dry eye conditions.

Stiffness and joint pain:

As we age, stiffness and joint discomfort can become common issues. Research has shown that omega-3 supplements can help reduce joint pain and improve grip strength. Additionally, omega-3 supplementation may alleviate symptoms in individuals with low omega-3 levels and reduce disease activity in patients with rheumatoid arthritis.

Changes in hair:

Omega-3 fatty acids support hair health by helping the skin retain moisture. Low omega-3 levels can lead to changes in hair density, integrity, and texture, resulting in thinning, dryness, or weakness. Taking omega-3 supplements may help improve these issues and promote stronger, healthier hair.

Fatigue and problems with sleep:

Identifying the exact cause of sleep problems can be difficult, but a deficiency in omega-3 fatty acids may be a contributing factor. Studies show that individuals with higher omega-3 intake tend to fall asleep more easily and stay asleep longer. Increasing omega-3 levels can significantly improve both the quality and quantity of sleep.

Problems regarding the heart:

Studies show that omega-3 fatty acids are essential for heart health. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) can lower triglyceride levels, a risk factor for cardiovascular disease. Increasing omega-3 intake is beneficial for those with heart issues, as it helps protect against heart disease and manage harmful cholesterol levels. The NIH recommends consuming omega-3-rich foods to maintain heart health and potentially prevent certain heart conditions.

CAUSES OF OMEGA-3 FATTY ACIDS DEFICIANCY

Dietary causes:

Low concentration of fatty fishlike salmon, sardines, and mackerel are rich in omega-3 fatty acids .Vegetarian or vegan diets: vegetarian and vegans may have limited sources of EPA and DHA .Low intake of nuts and seeds: nuts and seeds like flaxseeds chia seeds and walnuts are rich in ALA .High intake of processes foods: processed foods often contain high amount of omega-6 which can lead to imbalance

LIFE STYLE CAUSES: SMOKING:

smoking can reduce omega-3 levels in the body. STREES: chronic, stress can lead to inflammation which can deplete omega-3sLACK OF EXCERSISE: regular exercise can help improve omega-3 levels

MEDICAL CAUSES :

MALABSORPTION :

certain medical condition like chronic diseases ulcerative colitis diseases can impair omega-3 absorption

LIVER DISEASE :

liver disease can leads to affect omega-3 metabolism

OTHER CAUSES :

AGING :

omega-3 levels decline with age

ENVORMENTAL TOXINS :

exposure to envormental toxins like pesticide and heavy metals deplate omega-3 s

MEDICATION :

certain medication like statin and nasids can affects omega-3 levels

CONCLUSIONS:

Over the past two decades, omega-3 fatty acid (FA) supplementation has been recognized for reducing cardiovascular risks and benefiting conditions like metabolic syndrome, dyslipidemia, and diabetes. Omega-3s have anti-inflammatory properties useful for inflammatory joint diseases and may aid in treating neurological disorders, depression, and fetal learning issues. They can also

reduce the risk of premature birth during pregnancy. More research is needed on their effects on renal diseases, dementia, and obesity. Adults should aim for at least two servings of fish per week or 1 gram of omega-3s daily for health benefits.

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