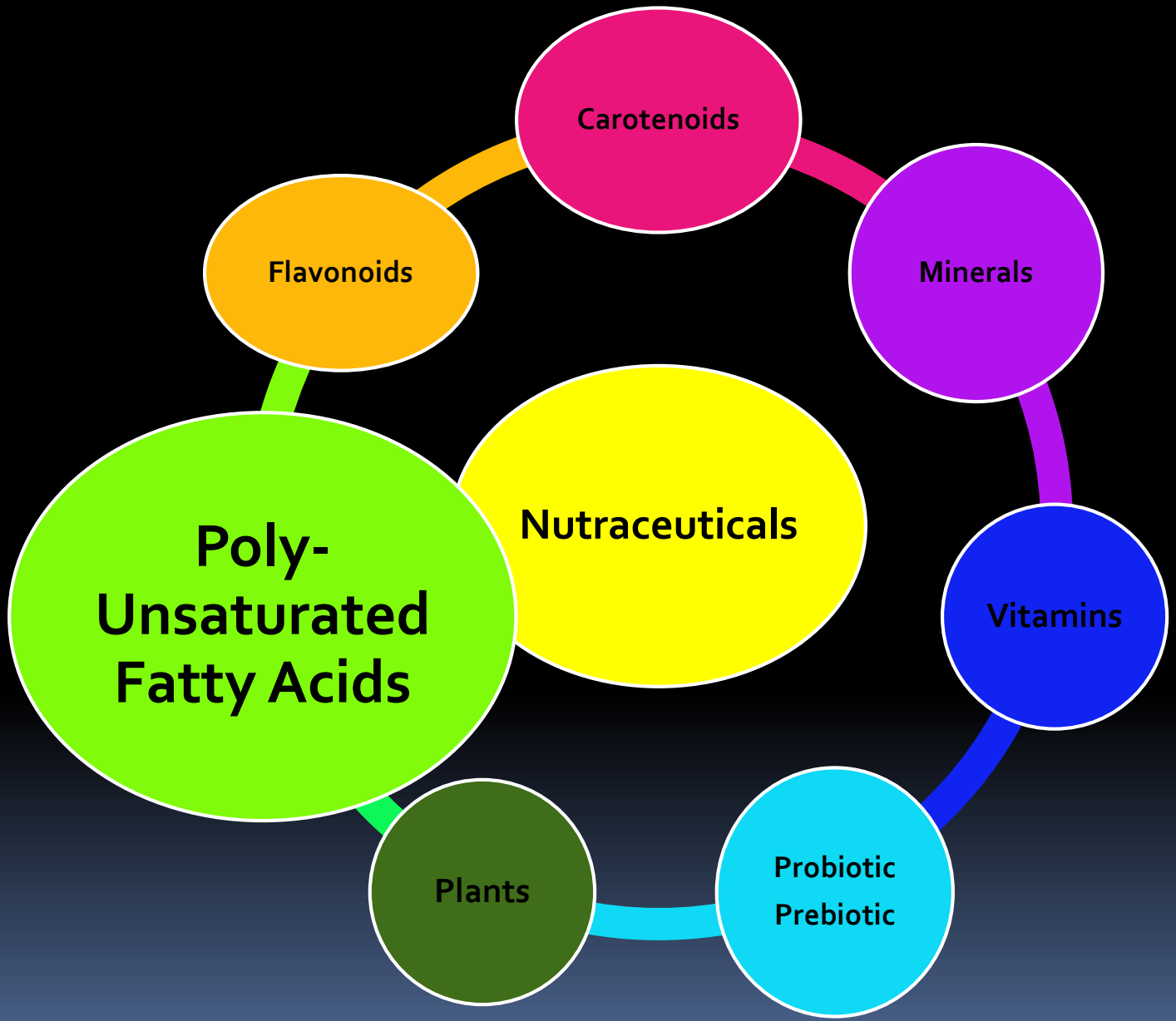

Carotenoids
Flavonoids
Minerals
Poly-
Unsaturated
Fatty Acids
Nutraceuticals
Vitamins
Plants
Probiotic
Prebiotic

Polyunsaturated Fatty Acids - PUFA

- 30% of a healthy diet should consist of fat.
- Oils which are rich in unsaturated fatty acids and essential fatty acids should be preferred.
- Unsaturated and essential fatty acids are necessary for regulating cholesterol level and blood pressure, strengthening muscle tissue, skin and skin health.

LIPIDS

- Lipids are vegetable or animal originated mixtures which are not soluble in water and ethanol-water mixture, on the other hand soluble in non-polar solvents (lipoid solvents).

LIPIDS

- Fatty acid + Alcohol = ESTER
- Due to their ester structure, when the lipids are heated with alkali hydroxides, saponification happens so, alcohol and soap is formed.

Other substances soluble in lipoid solvents

- Long chained → hydrocarbons, alcohols, ketons, phloroglucinols, quinone compounds
  - They cannot be saponified because they do not contain ester structure.
  - These compounds form non-saponifying lipids
  - The effects of these compounds are also different due to their different chemical structure.

LIPIDS

- LIPID ------ Saponified lipids
- ------- Non-saponified lipids

Saponified Lipids

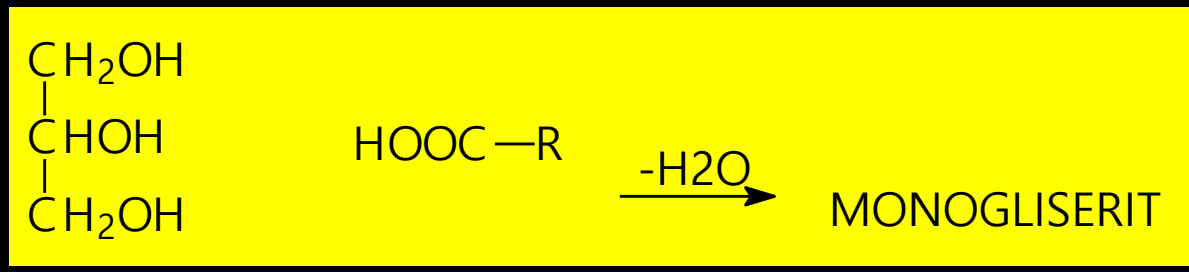
- 1) Simple lipids (C,H,O): Fats and waxes
- 2) Compound/Complex Lipids (C, H, O + S, N, P): Phospholipids (phosphatide), Phosphoamino lipids
- 3Derived Lipids: Steroids, hydrocarbons, ketone bodies

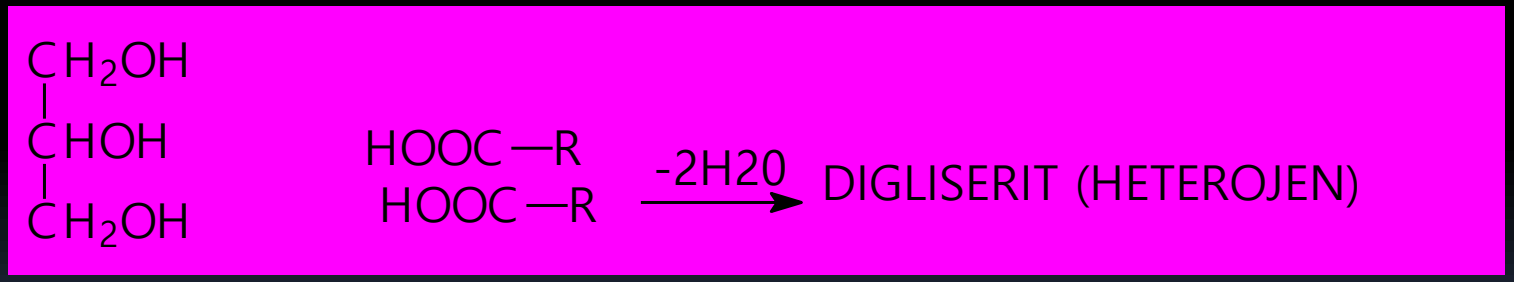
Simple Lipids

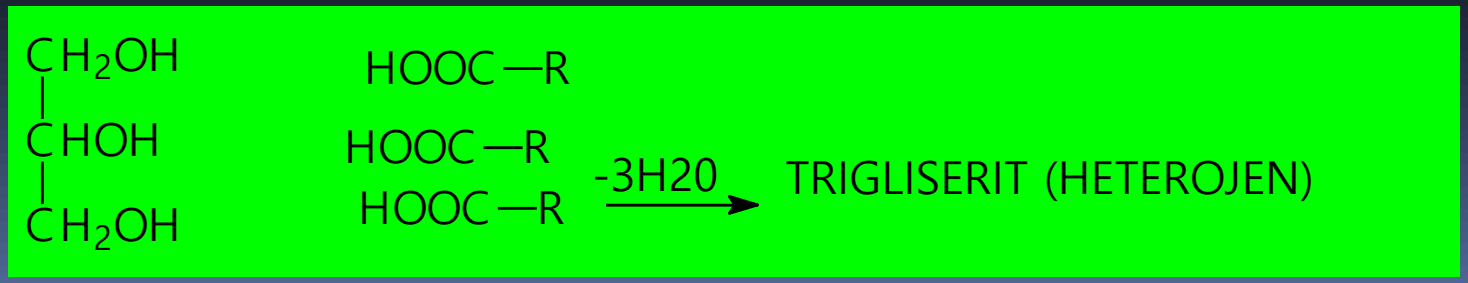
- Esters of simple saponified lipids:
- 1) Fats; esters of fatty acids and glycerol
- 2) Waxes; esters of long chain fatty acids and long chain alcohols

Glycerides - Acylglycerols

- 1) Glycerides---- compose fixed oils (Oleum-Olea)







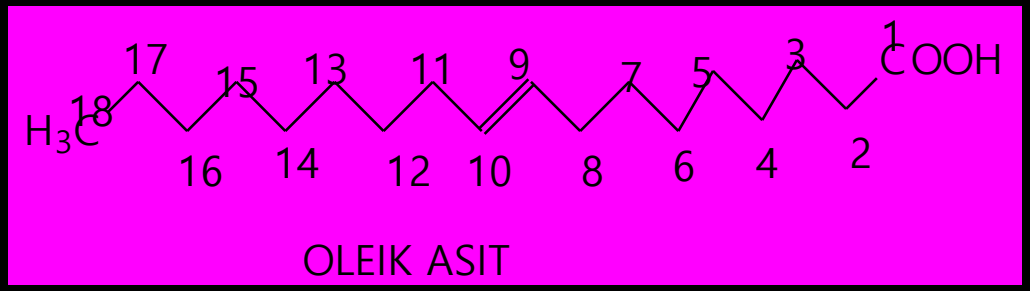
Fatty Acids

- The effective part of lipids are fatty acids. Alcohols have no effect.
- **Fatty acids:**
- **1) Saturated fatty acids (aliphatic)**
- **2) Unsaturated fatty acids (aliphatic)**
- **3) Cyclopentenic fatty acids**
- **4) Hydroxy fatty acids**
- **5) Acetylene fatty acids**

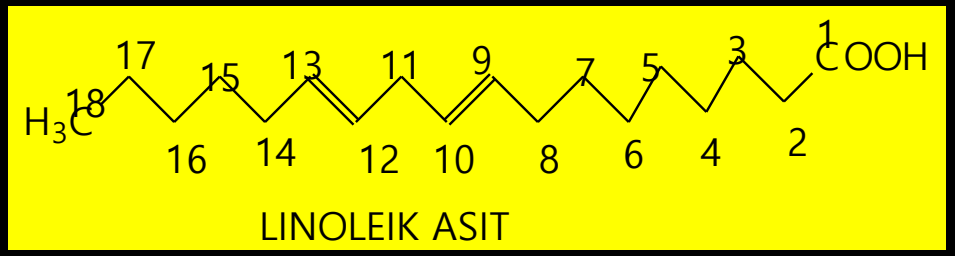
Unsaturated fatty acids

- Unaturated fatty acids : $C_nH_{2(n-a)}O_2$
- a= number of double bonds. Mostly 18 C membered.
- n= 18---Oleic acid a=1 (9-10)
- n= 18---Linoleic acid a=2 (9-10, 12-13)
- n= 18---Linolenic acid a=3 (9-10,12-13,15-16)
- n= 20--Arachidonic acid a=4 (5-6,8-9,11-12,14-15)

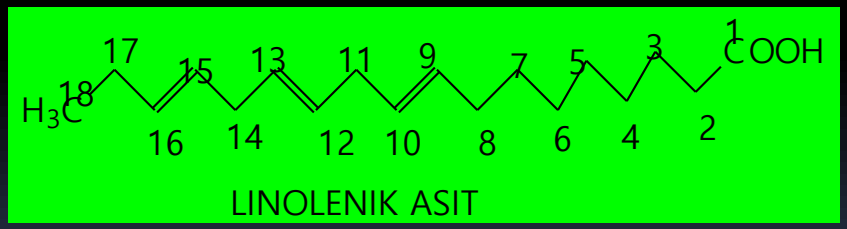
Unsaturated fatty acids



OLEIK ASIT



LINOLEIK ASIT



LINOLENIK ASIT

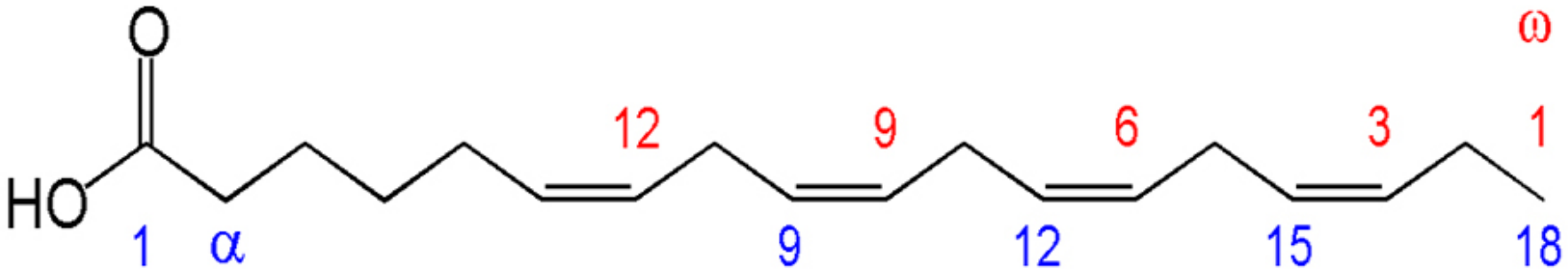
ARASIDONIK ASIT

Distribution in Nature

- A) Vegetable/Herbal sources: Found in fruit and seeds or endosperm and cotyledones (olive oil, sesam oil)
- B) Animal Sources: Found in various organs (fish oil, lard)

Omega Fatty Acids

- Omega 3 (Alpha Linolenic acid), omega 6 (Linoleic acid) and omega 9 (Oleic acid). Omega fatty acids prevent the risk of heart attack by decreasing the cholesterol level and preventing the blood from clotting as well as protecting and strengthening the immune system.



Alfa-linolenik Asit (Omega-3)

- Heart disease, diabetes, high blood pressure and cancer are almost never seen in Eskimos.
- It has been shown that they consume about 10,000 mg fish oil, omega-3 daily.
- Fish oil is mostly found in salmon, sea bass, turbot and tuna fish that live in cold waters.

- There is much less oil in fish living in hot waters.
- Foods such as almonds, walnuts and flax seeds are rich in omega fatty acids.

- How much should we take:
- FDA recommends daily up to 3000 mg
- Even 10 times this amount is safe..
- Children and adults should take a dose of 1500-3000 mg

- Omega 3:
- Reduces the risk of sudden death by 45%.
- It has been shown to reduce the mortality rate in intensive care unit (ICU) patients over 7000 mg, shorten the length of stay in the ICU and decrease the need for antibiotics.
- Patients with palpitations had the same results as beta blockers but had no side effects.

- Compared with cholesterol-lowering drugs, it is more effective and has no side effects such as liver and muscle tissue destruction and sexual weakness.
- Decrease Alzheimer's disease risk by 50%
- Macular degeneration improves by 40% and the risk decreases by 75%.

- It was determined that cholesterol level returned to normal levels by taking 3000 mg/daily
- Significant improvement in depression at 1000 mg dose.
- Recommended during pregnancy. It was observed that the duration of pregnancy was prolonged, the birth weight of the baby increased and the risk of preterm birth decreased in n-3 fed mothers.
- Necessary for brain development. In children it is recommended as a daily dose of at least 1500 mg.

- n-3 fatty acids are anti-inflammatory and inhibit platelet aggregation.
- **There are also many biological effects in the body, such as lipoprotein metabolism, endothelial cell function, vascular reactivity, cytokine production, coagulation and fibrinolysis.**
- n-3 shows anti-inflammatory effect by **inhibiting VASCULAR INFLAMATION.**

Other tasks of n-3

- In a scientific paper issued by the American Heart Association in 2002, it was stated that the use of n-3 fatty acids was effective in preventing CVD primarily and secondarily.

- **Anti-arrhythmic and anti-atherosclerotic.** Improves endothelial function, lowers blood pressure and triglyceride levels.

n-3 and Obesity

- The diet containing fatty acids rich in n-3 reduces adipose development and increases β-oxidation of adipose tissue.
- Thus, the growth of fat cells slows down and the risk of obesity in children is reduced.

- **Linseed oil carries vegetable omega fatty acid components.** Keten tohum yağı omega 3 yağ asidi olan

- Flaxseed oil is a rich source of alpha-linolenic acid (ALA) which is omega 3 fatty acid and linoleic acid which is an omega 6 fatty acid. Alpha-linolenic acid cannot be synthesized by the body and must be taken with foods.

- Flaxseed oil helps to support cardiovascular health and to balance blood cholesterol and triglyceride levels.

- Provides fluidity of blood and prevents vessel blockage and accumulation of fat in vessels.
- **Minimizes the risk of heart attack.**
- Omega 3 fatty acids help to raise good cholesterol and to lower bad cholesterol.

Omega-6 fatty acids

- Protects skin health, provides flexible and smooth skin formation, thus, protection of skin from injuries and infections, regulation of body temperature and water loss is provided.
- It is stated that essential fatty acids are effective against inflammation in baby rashes.
- The ratio of omega-6 and omega-3 fatty acids to each other in the body (n-6 / n-3) is very important. In an ideal diet, the expected n-6/n-3 rate should be between 5:1 and 10:1.

Conjugated linoleic acid - CLA

- Geometric and positional isomers of linoleic acid (cis-9, cis-12, octadecadienoic acid)
- While the major isomer in natural sources is cis-9, trans-11, commercial preparations contain approximately equal amounts of cis-9, trans-11 and trans-10, cis-12 isomers.

Biological effects of CLA

- Reducing body fat,
- İmmune enhancer
- anticancer
- antidiabet,
- antiobesity and
- antiatherogenic properties and have beneficial effects on human health

- Antioxidant properties of CLA to human tumor cells (colon, breast and prostate),
- There are many health beneficial effects, such as dietary effects and anti-obesity, lowering the accumulation of triacylglycerol in the liver.
- Trans-10, cis-12 CLA is one of the isomers of CLA, which reduces fat in the body,
- There is also information that cis-9 and trans-11 CLA have anticarcinogenic effects.

- CLA reduces cholesterol that promotes atherosclerosis and reduces the level of triglycerides that are effective in the risk of heart attack
- It is stated that CLA and omega fatty acids help the blood to be easily pumped by the heart by providing fluidity, thus preventing vascular blockage and accumulation of fat in the vessels.

- The main source of CLA is dairy products such as ruminant animal meats, milk and cheese.
- Cow's milk contains 3.38-6.39 mg CLA/g fat, but significant changes occur in dairy products during processing.

- Recommended consumption of CLA is 212 mg / day for men and 151 mg / day for women.

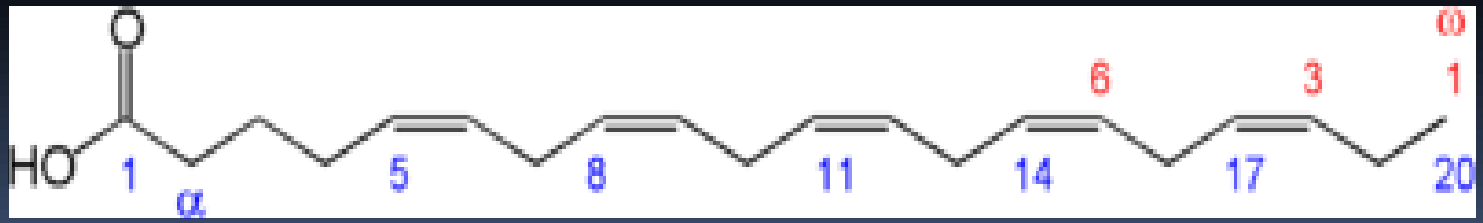
- It is stated that 60% of the requirement is obtained from dairy products and 37% from meat products generally as cis-9, trans-11 CLA isomers.

Fish and Fish Oil

- **Fish oil contains omega 3 fatty acids (EPA and DHA) which are very important for heart health.**
- EPA and DHA in fish oil → lowers cholesterol and triglyceride levels, slows the formation of arteriosclerotic plaque and reduces the risk of heart attack.

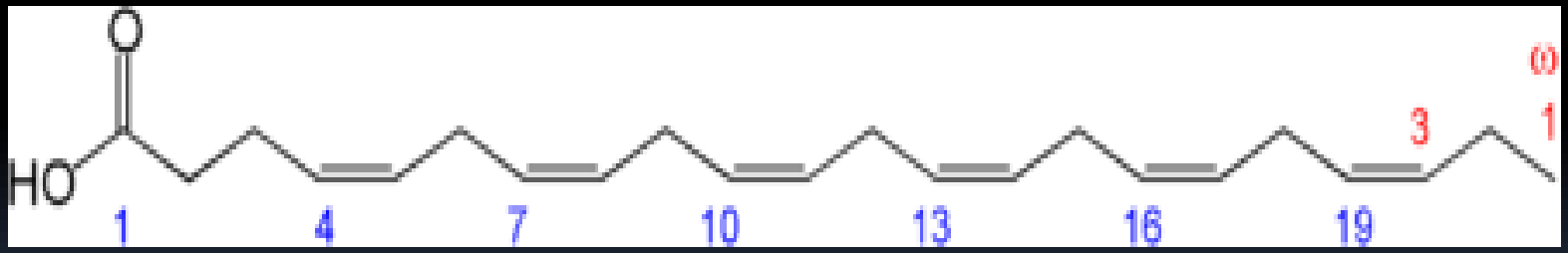
EPA (20:5 (n-3) Eicosapentaenoic acid)

- **Chemical structure:** It is a carboxylic acid containing 20 carbon chains and 5 cis-double bonds.
- The first double bond is located in 3rd carbon from the omega tip.



DHA (Docosahexaenoic acid)

- **Chemical structure:** It is a carboxylic acid containing 22 carbon chains and 6 cis-double bonds. The first double bond is in 3rd carbon from the omega tip.



Diseases Prevented by EPA and DHA

- They show prophylactic (protective) or therapeutic effects on certain diseases such as heart attack, cardiovascular disease, depression, migraine headache, joint rheumatism, diabetes, high cholesterol, hypertension, hyperactivity and attention deficit (ADHD), certain allergies, arteriosclerosis, asthma, and cancer.

- It also has many benefits in fatigue, acne, eczema, multiple sclerosis and anemia.

Omega 5

- Omega 5 is a very powerful antioxidant, 6 times more effective than grape seed extract.
- It inhibits the production of prostoglandins and leukotrienes that cause diseases and cause inflammation.
- Aspirin-like non-steroidal anti-inflammatory effect with no side effects.

Omega 5

- Omega 5 repairs damaged cells. Regulates glucose transport. Increases the sensitivity of cells to insulin.
- It is effective in hormonal and metabolic problems in women.
- Omega 5 has the potential to be "essential fatty acid" in parallel with clinical studies.

Pomegranate Seed Oil

- Pomegranate Seed Oil protects the skin against free radicals and helps to make skin texture look more shiny and elastic.
- Approximately 60% of Pomegranate Seed Oil is punicic acid. This fatty acid shows antioxidant properties and strengthens the health protective effect of the oil.

Pomegranate Seed Oil

- It contains 0.6% vitamin E in addition to punicic acid (Omega 5) and contains polyphenols with antioxidant properties.
- Pomegranate seed oil contains high levels of conjugated fatty acids (CLA). Conjugated fatty acids of animal origin contain two double bonds, while conjugated fatty acids in the structure of pomegranate seed oil contain three double bonds.

- Sphingolipids → A class of compound lipids containing a backbone of sphingoid bases, a set of aliphatic amino alcohols and fatty acids that includes **sphingosine**. They are glycerol free fatty acids
- Phosphate containing sphingolipids → sphingomyelins
- Phosphate-free and carbohydrate-containing ones are known as glycolipids.

- **Sphingosine:** Skeletal structure of sphingophospholipids.
- **Ceramide:** Sphingosine + fatty acid; intermediate in the synthesis of other sphingolipids
- **Sphyngomyelin :** Ceramide + colin phosphate; forms the myelin sheath structure surrounding nerve fibers in CNS.

- Sphyngolipids were firstly isolated in 1884 by JLW Thudichumduring identification of chemical compounds in the brain. In addition to some prokaryotic and viruses, sphingolipids play important roles as structural compounds in the membranes of eukaryotic organisms.

- Functional components, not only effective on structure but also regulatory functions.

- Sphyngolipids found in:
  - Milk and dairy products 0,5-1 µmol/g,
  - Meat and meat products 0.3- 0.5 µmol/g,
  - Fruits and vegetables < 0,1–2 µmol/g.
- Does not meet the body needs in food intake
- Daily intake is between 0,3–0,4 g.

Sphyngolipids are important in;

- Cell growth, differentiation and apoptosis (especially ceramides)
- Signal transmission (especially ceramides)
- Myelin sheath structure (especially sphingomyelin)
- Cell-cell communication (especially glycophospholipids)
- Immune diagnosis (oligosaccharide portions of glycophospholipids are the component of antigenic structure of blood groups)

- Sphingosine, the cleavage product of sphingolipids, is a strong signaling molecule → because Ca2+ channels opened by electrical stimulation directly affect each other and change Ca+2 homeostasis.

- Sphingolipids have been found to inhibit both early and late stages of cancer.
- There was also a significant change in tumor type; change from malignant lymph cancer to benign adenomas.

- Sphingolipids have been found to be therapeutic as well as preventive, with shrinkage of the tumor when mice are fed with sphingomyelin before and after tumor onset.
- Foods rich in sphingolipids are important in preventing colon cancer.

- Other milk-derived sphingolipids such as glucosylceramide, lactosylceramide and ganglioside GD3 may have similar effects and inhibit cancer cell formation by 50–60%

- Sphingolipids play an important role in the absorption of cholesterol from the small intestine. Studies have shown that it significantly reduces cholesterol absorption.

- Sphingolipids, such as ceramide and ceramide 1 phosphate, play an important role in the development, activation and regulation of the immune system.
- These compounds are low in normal milk and high in colostrum milk.

Inhibition of Pathogenic Bacteria

- Milk oil has a preventive effect in gastrointestinal infections.
- Generally gram-positive bacteria are more sensitive to lipids than gram-negative bacteria.
- C10, C12 fatty acids and fatty acids of sphingolipids have bactericidal effect