



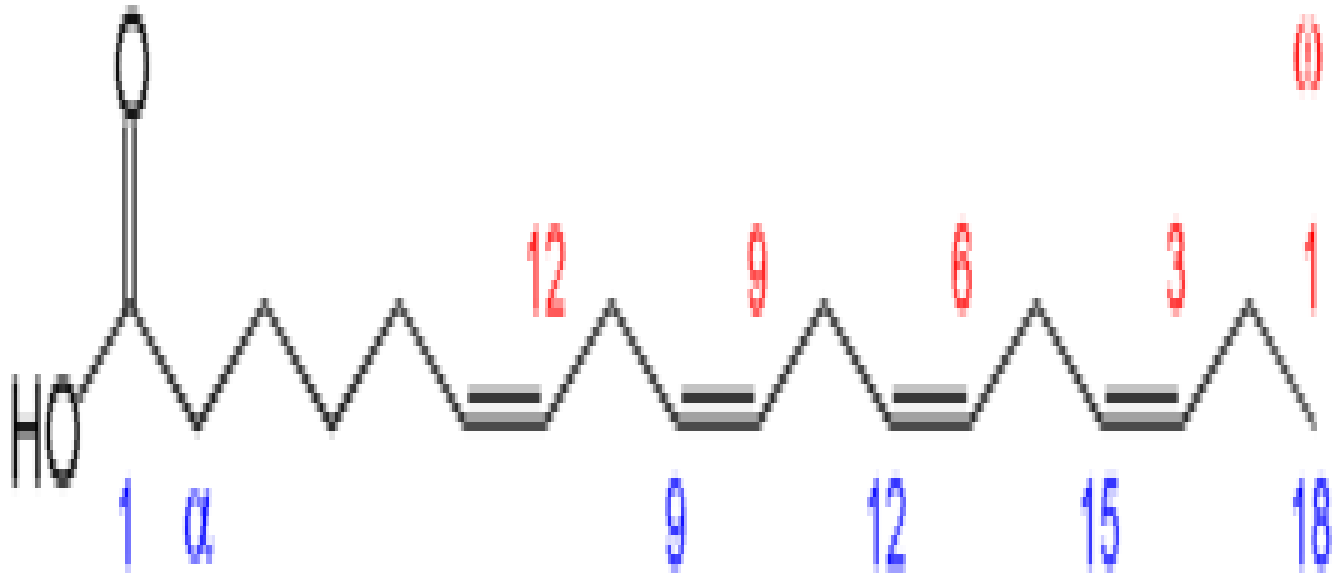
DIETARY SUPPLEMENTS(1)

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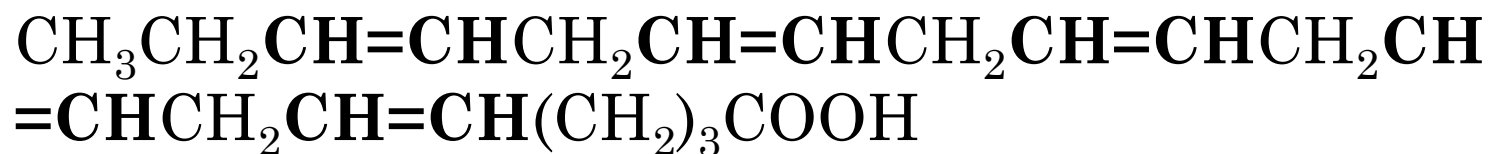
FOODS UNDER THE MICROSCOPE

nutrients	
Micronutrients	Vitamins, Minerals,?
Macronutrients	Carbohydrates, Proteins,Lipids,Fibers,Water,Minerals
Phytochemicals	Secondary plant metabolites
Non nutrients	
Food additives: Natural OR synthetic	Colourings,flavourings,preservatives,thickener ,humectants,food acids,antioxidants
Contaminants	Natural contaminants, industrial pollutants,processing contaminants,?

UNSATURATED FATTY ACIDS



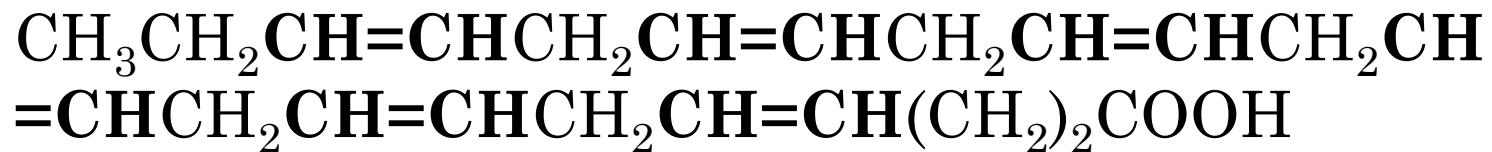
- Eicosapentaenoic acid



- 20:5

- *n*-3

- Docosahexaenoic acid



- 22:6

- *n*-3

FISH OIL

- There are two types of fish oil:
- **Fish liver oil** (generally derived from the liver of the cod, halibut or shark)
- **Fish body oil** (generally derived from the flesh of the herring, sardine or anchovy).

CONSTITUENTS

- Both fish oil and fish liver oil are sources of omega-3 long-chain polyunsaturated fatty acids (LCPUFAs):
 - Eicosapentaenoic acid (EPA)
 - Docosahexaenoic acid (DHA)
 - They also contain vitaminE

FISH LIVER OIL

- Contains:
- vitaminA (750–1200mcg/daily dose)
- vitamin D (2.5–10mcg/daily dose)

HUMAN REQUIREMENTS

- World Health Organization (WHO):
- Two portions of fish/week
- equivalent to 250–500mg/daily EPA+DHA

- EPA and DHA can also be synthesised in the body from alpha-linolenic acid (found in vegetables oils, e.g. soyabean, linseed and rape seed oils, and nuts and seeds, e.g. walnuts,
- hemp and pumpkin), but conversion is poor (about 4%)



DIETARY SOURCES

- Oily fish: mackerel, herring, kippers, pilchard, sardines, tuna, salmon.



ACTION

- Fish oils have several effects, which are thought to result from a reduction in inflammatory and thrombotic prostaglandins, and leukotrienes and inflammatory cytokines

- Alteration of lipoprotein metabolism: reduced triglycerides; mixed effects on low- and high-density lipoprotein (LDL- and HDL)-cholesterol.
- Inhibition of atherosclerosis.
- Prevention of thrombosis.
- Reduction in heart rate.
- Influence of arrhythmias.
- Inhibition of inflammation.
- Inhibition of immune response

BIOAVAILABILITY

- Supplements of fish oil and fish liver oil typically provide 100–2000mg EPA+DHA per daily dose, sold as liquid oil or in soft gel capsules.
- Studies have shown that concentrations of EPA and DHA in tissues, chylomicrons and serum are increased in response to supplementation with pure oils.

PRECAUTIONS/CONTRAINDICATIONS

- Monitor patients on **anticoagulants** (e.g. aspirin, warfarin).
- Stop supplementation before surgery.
- Vitamin **A** and **D** concentrations (if other supplements are taken concomitantly).
- Contaminants (e.g. dioxins, polychlorinated biphenyls); maximum contaminant level regulated by UK Committee on Toxicity (COT) and EU Scientific Committee on Food (SCF).

PREGNANCY/BREASTFEEDING

- Avoid fish liver oils (vitamin A content).

ADVERSE EFFECTS

- Possibly increased risk of bleeding ($>3\text{g/day}$ EPA+DHA).

INTERACTIONS

- Anticoagulants(e.g. aspirin, warfarin): possibly increased risk of bleeding.
- Bilberry, bromelain, dong quai, feverfew, flaxseed, garlic, ginger, ginkgo, ginseng, glucosamine, vitamin E: possibly increased risk of bleeding.

DOSE

- See human requirements: follow recommendations for fish intake.
- If oily fish is not consumed:
 - -healthy adults, EPA+DHA, up to 450mg daily
 - -people with cardiovascular disease, EPA+DHA, 0.5–1g daily.
- Studies in arthritic conditions have used doses of EPA+DHA of 2–3g daily.
- Studies in depression and other mental conditions have used doses of 1–10g daily.
- Such doses should be used under medical supervision.



FLAXSEED OIL

- Flaxseed is the soluble fiber mucilage obtained from the fully developed seed of *Linum usitatissimum*.

CONSTITUENTS

- Alpha-linolenic acid and lignans.
- Alpha-linolenic acid is an essential fatty acid of the n-3 (omega-3) series, which can be converted into longer-chain fatty acids of the n-3 series, such as EPA and DHA. Conversion is limited.

ACTION

- Source of omega-3 fatty acids.
- Omega-3 fatty acids are precursors to a range of prostaglandins, thromboxanes and leukotrienes, which are less proinflammatory than those of the n-6 series

POSSIBLE USES

- Reduces cholesterol
- Reduces risk of cardiovascular disease
- Many help prevent cancer
- Alleviates arthritis pain
- Improves symptoms of eczema
- Improves symptoms of psoriasis
- Improves symptoms of lupus

- Bioavailability
- Lack of significant data.
- Precautions/contraindications
- None.
- Pregnancy/breastfeeding
- No safety data.
- Adverse effects
- No known side effects or toxicity.
- Interactions
- None reported.
- Dose
- Not established.



EVENING PRIMROSE OIL

- Evening primrose oil is derived from the seeds of *Oenothera biennis* and other species.
- It is synthesised endogenously from dietary linoleic acid (C18:2,n-6).
- Diabetes impairs this conversion

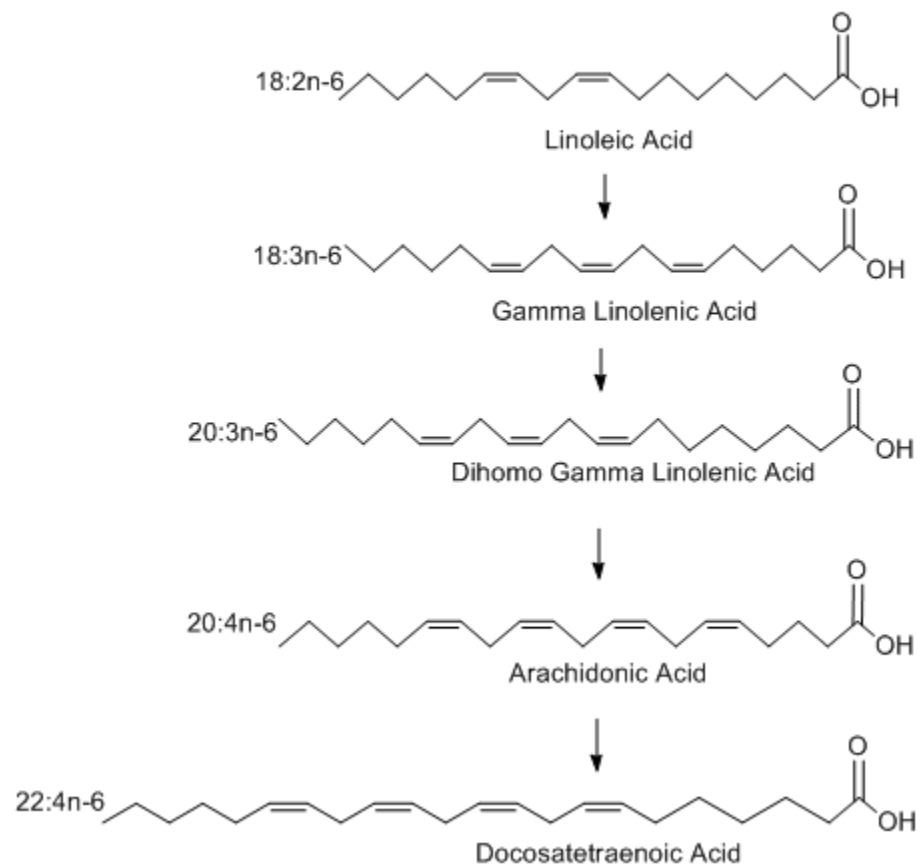
CONSTITUENTS

- The oil content of the seeds is 17–25%, of which 8–11% is gamma- linolenic acid (GLA, C18:3,n-6).

ACTION

- Precursor of dihomogamma- linolenic acid (DGLA), series 1
- prostaglandins (PG1s) and arachidonic acid.
- Activity of GLA is thought to be due to production of PG1s at expense of PG2s.
- PG1s have less inflammatory activity than PG2s.
- PGE1 is a platelet aggregator and vasodilator

Linoleic Acid Metabolism



POSSIBLE USES

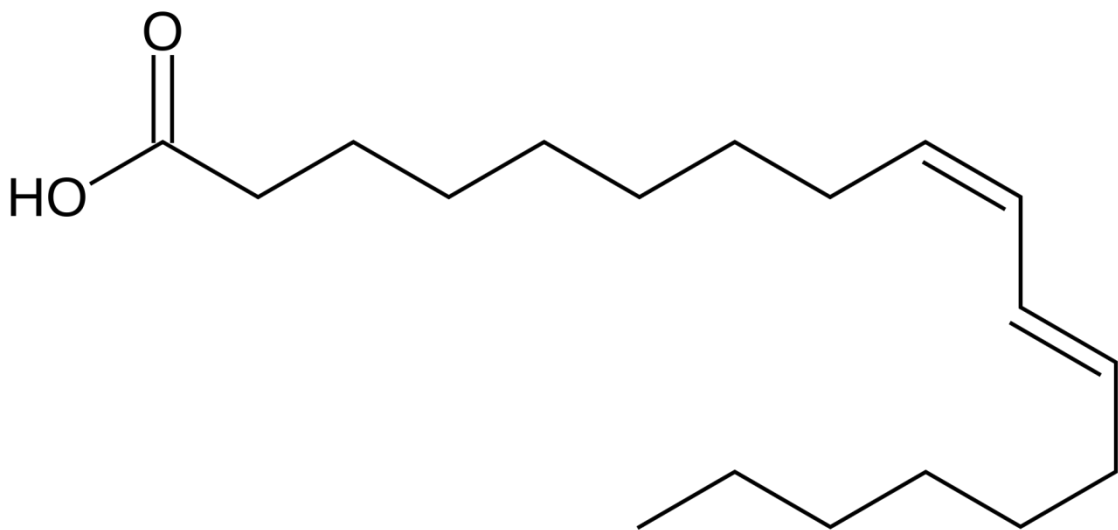
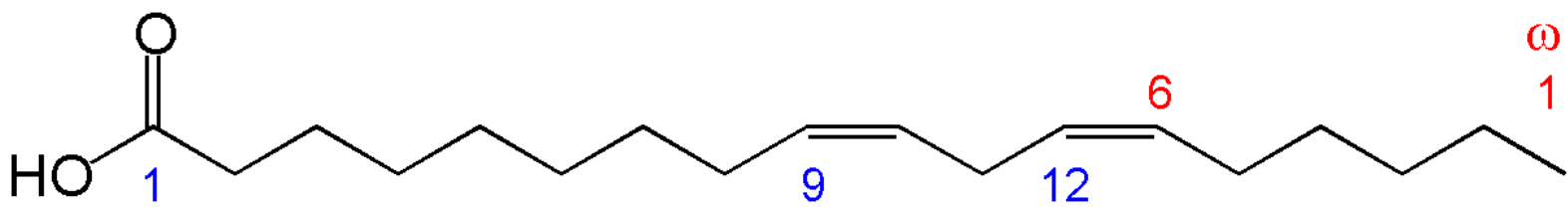
- Improves eczema
- Reduces symptoms of PMS
- Reduces symptoms of rheumatoid arthritis
- Improves diabetic neuropathy
- Improves dry eye syndrome
- Improves periodontal disease
- Reduces risk of heart disease
- Reduces risk of breast cancer
- Improves asthma
- Prevents hair loss

BIOAVAILABILITY

- Acute administration of 280mg GLA from 3g of evening primrose oil resulted in a significant increase in plasma GLA concentrations in six volunteers. Maximum levels were reached in 2.7–4.4hours.

- Precautions/contraindications
- Use of GLA has been associated with **epilepsy** and **seizures**. Recently, how-ever, this has been questioned.
- Pregnancy/breastfeeding
- Caution because of **hormonal effects**.
- Adverse effects
- Low toxicity. Nausea, diarrhoea and headache reported occasionally.
- **Interactions**
- Drugs
- Phenothiazines: possibly increased risk of seizures, but this is now questioned.

- Dose
- Symptomatic relief of eczema: 320–480mg (as GLA) daily; child aged 1–12 years, 160–320mg daily.
- Symptomatic relief of cyclical and non-cyclical mastalgia: 240–320mg (as GLA) daily for 12 weeks (then stopped if no improvement).
- Dietary supplements provide 40–300mg (as GLA) per daily dose.
- Note: doses are given in terms of GLA; evening primrose oil supplements are not identical; they provide different amounts of GLA



PUMPKIN SEEDS

- Pumpkin seeds are the seeds of *Curcubita pepo*.

CONSTITUENTS

- Pumpkin seeds contain 30–50% oil.
- The main fatty acids are **linoleic** (n-6 polyunsaturated fatty acid), **oleic** (n-9 monounsaturated fatty acid), and the saturated fatty acids **palmitic** and **stearic acids**.
- Pumpkin seeds also contain a small amount of **linolenic acid** (n-3 polyunsaturated fatty acid) and **phytosterols**.
- The oil is rich in **vitamin E** and contains a range of other vitamins and minerals (e.g. **vitamin A, B vitamins, magnesium, iron, zinc and copper**).

ACTION

- Associated with diuretic, anthelmintic, antihypertensive, anti-diabetic, anti-inflammatory, antioxidant, anti-tumour, hypocholesterolaemic and immunomodulatory activity, ACE inhibitory and α -glucosidase activity, suggesting that pumpkin seeds could reduce the risk of complications linked to hypertension and hyperglycaemia.

POSSIBLE USES

- Improve symptoms of benign prostatic hyperplasia (BPH) I
- Reduce risk of kidney stones I
- Lower cholesterol C
- Improve insulin and glucose control in diabetes P
- Improve symptoms of irritable bowel syndrome (IBS) I

- **Precautions/contraindications**

- None known.

- **Pregnancy/breastfeeding**

- No harmful effects reported. No long-term data exist on pumpkin seed supplements.

- **Adverse effects**

- Allergic reactions.

- **Interactions**

- None reported.

- **Dose**

- Not established. Supplements generally contain 300–600mg of pumpkin seed oil. For BPH, pumpkin seed oil, 480mg in three divided doses has been used.

CONJUGATED LINOLEIC ACID

- Conjugated linoleic acid (CLA) is a class of conjugated isomers of the poly-unsaturated fatty acid, linoleic acid. It contains two double bonds separated by a single bond.

- The main isomers identified in foods are cis-9, trans-10(c9,t11)- and trans-10,cis-12 (t10,c12)-CLA. CLA is found in low concentrations in blood and other tissues, although it is not synthesised endogenously in humans. It is produced naturally by microorganisms associated with digestion, particularly in the rumen of cattle

- Human requirements
- No proof of dietary need exists.
- Dietary sources:
- Beef, lamb, dairy produce.
- Action:
- Antioxidant.
- Enhances immune function (in animals).
- Enhances delivery of fat into cells.
- Transports glucose into cells to provide energy and build muscle (rather than converting glucose to fat).

POSSIBLE USES

- Enhances weight loss
- Reduces lean body mass and increases fat mass
- Improves lipid profile
- Improves insulin resistance
- Reduces risk of cancer
- Improves bone metabolism
- Improves immune function

- Bioavailability
- Biologically active CLA isomers are (c9,t11)-CLA and (t10,c12)-CLA.
- Several products contain the patented Clarinol or Tonalin formulas, which contain these isomers.

- Precautions/contraindications
- Insulin resistance.
- Pregnancy/breastfeeding
- No problems reported; insufficient data.
- Adverse effects
- No known adverse effects, except gastrointestinal effects, but no long-term studies. Lipid peroxidation reported in obese men with dose of 4.2g/day; significance unknown.
- Interactions
- None reported.
- Dose
- Not established. Supplements provide 1–4g/day.




Description

- Antioxidant:
- a substance that delays or prevents oxidation

Constituents


- Nutrients with antioxidant properties include:
- beta-carotene, vitamins A, C and E
- selenium, lycopene, lutein, zeaxanthin
- flavonoids (e.g. anthocyanins, polyphenols, quercetin).
- The body also produces antioxidants: alpha lipoic acid, coenzyme Q10 and glutathione.


- 
- copper and zinc :
 - necessary to strengthen the body's own antioxidant protection system.
 - Supplements marketed with antioxidant properties :
 - carnitine, green tea, pine bark extract and resveratrol

Dietary sources

- fruit, vegetables and other plant foods.

- The best sources:
- The most colourfull ones :
 - Berries: blueberry, cranberry, raspberry, strawberry
 - Kiwi and citrus fruit
 - Legumes: broad beans, pinto beans, soya beans
 - Walnuts, sunflower seeds
 - Vegetables: kale, spinach, Brussels sprouts, beetroot, red cabbage, button mushrooms, peppers
 - Cereals: barley and oats

- 
- unstable oxygen molecules called free radicals
 - Free radicals are highly reactive substances
 - result from normal cellular oxidative metabolism and exposure to environmental insults, such as cigarette smoke, ultraviolet light, chemical pollutants and some medications.

- 
- oxidant compounds:
 - can cause extensive cell damage to the body's cell membranes, proteins and DNA.
 - Damage accumulates over time and can lead to a variety of health problems such as cardiovascular disease, cancer, macular degeneration, cataract, Parkinson's disease and Alzheimer's disease.

Action

- Protect body tissues from the harmful effects of free radicals

Possible uses

- Observational studies suggest:
- an inverse association
- between consumption of dietary antioxidants and risk of chronic disease such as Alzheimer's disease, arthritis, cancer, cardiovascular disease, cataracts, diabetes, macular degeneration and Parkinson's disease.

- In vitro studies:
 - antioxidant compounds have a positive influence on various disease risk factors: endothelial function, platelet aggregation, joint damage and cellular processes involved in carcinogenesis.
- Placebo-controlled clinical trials:
- have largely failed to show a benefit of antioxidant supplements and in some cases have suggested adverse effects

Possible uses


- Cardiovascular disease I
- Cancer I
- Cataract P
- Age-related macular degeneration P
- Arthritis I
- Mental performance I
- Physical performance P
- Pre-eclampsia I
- Asthma I

Bioavailability

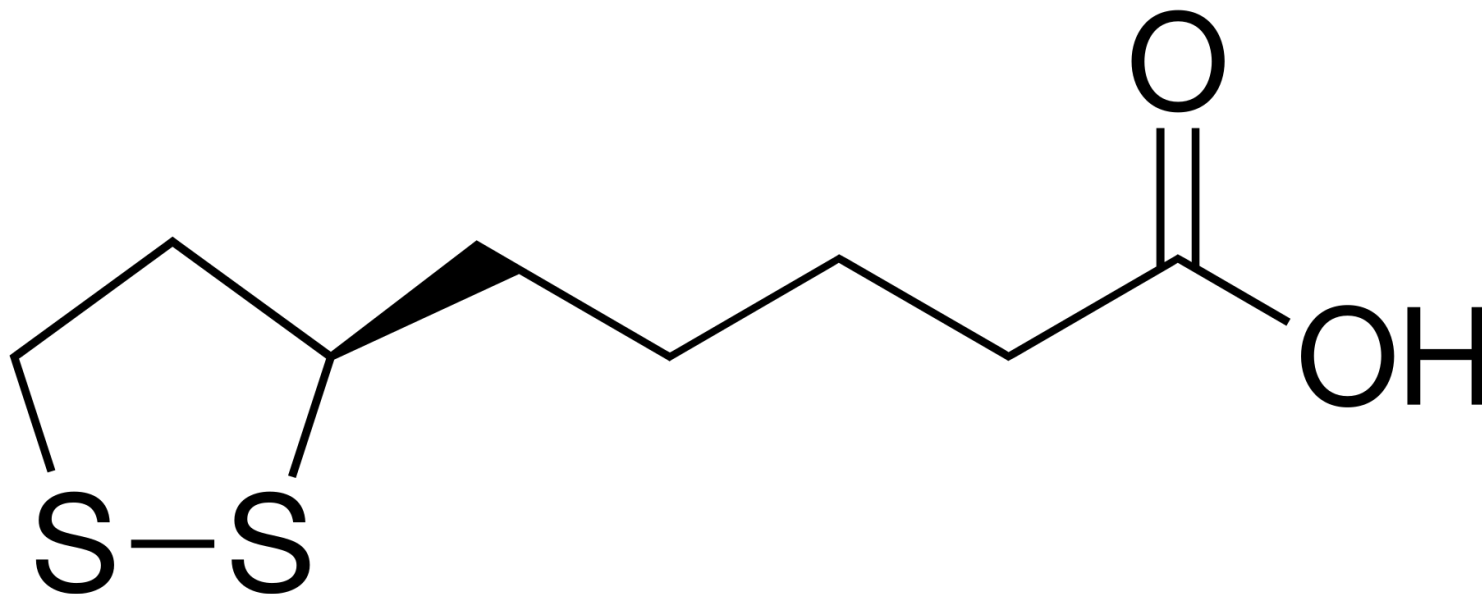
- Vitamin C
- Vitamin E
- Synthetic vitamin E (d,l-alpha- tocopherol)
Vs. natural vitamin E (d-alpha- tocopherol).
- other antioxidants such as carotenoids and flavonoids

- Adverse effects
- A few studies have shown increased risk of cardiovascular disease and cancer with high dose antioxidant supplements.
- Beta-carotene supplementation(20mg/day) has been associated with increased risk of cancer in smokers, History of asbestos exposure.

- Interactions
- Taking beta-carotene, selenium, vitamin C, and vitamin E together might decrease the effectiveness of some medications:
 - Statins
 - Niacin

- 
- Dose
 - Antioxidant vitamins and minerals are best avoided in doses exceeding the RDA (recommended daily allowance).

Alpha-lipoic acid



Description

- Alpha-lipoic acid
- alpha-lipoate, thioctic acid, lipoic acid, 2-dithiolane-3-pentatonic acid, 1,2-dithiolane-3-valeric acid
- a naturally occurring sulphur-containing cofactor.

Human requirements

- It is not essential
- Diabetes mellitus, liver cirrhosis and atherosclerosis are associated with low levels of alpha lipoic acid.
- It is difficult to obtain amounts used in clinical studies from foods

Dietary sources

- Kidney, heart, liver, spinach, broccoli, potatoes and brewers' yeast


Action

Antioxidant:


- is able to scavenge reactive oxygen species and other metabolites such as glutathione or vitamins.
- **Cofactor** for various enzymes in energy-producing metabolic reactions
- Increases cellular uptake of glucose
- May protect against mercury, arsenic and lead **poisoning**


Possible uses

- Diabetes mellitus
- Improves glucose metabolism
- Improves insulin sensitivity
- Diabetic neuropathy
- Glaucoma
- HIV
- Dementia
- Hypertension
- Burning mouth syndrome
- Age-related hearing loss (prevention)
- Migraine (prevention)
- Obesity


- 
- **Bioavailability**
 - 30% absorbed from supplements or foods
 - is reduced to dihydro lipoic acid in many tissues.

- 
- Precautions/contraindications
 - Diabetes mellitus and hypoglycaemia.

- 
- Excessive use of alcohol
 - Causes thiamine(vitamin B1) deficiency:
 - Taking alpha-lipoic acid, might cause serious health problems.


- 
- **Pregnancy/breastfeeding**
 - Possibly Safe/Insufficient data
 - Pregnant women have safely taken up to 600 mg daily for up to 4 weeks.
 - start as early as the 10th week of pregnancy and continue as late as the 37th week of pregnancy.

- Adverse effects
 - Children:
 - by mouth, in large amounts is POSSIBLY UNSAFE
 - Seizures, vomiting, and unconsciousness has been reported for a 14 month-old girl and a 20 month-old boy who took up to 2400 mg of alpha-lipoic acid in a single dose.
 - Stop taking alpha-lipoic acid 2 weeks before elective surgical procedures.
-
- No long-term safety studies. Skin rashes, gastrointestinal effects, nausea and headache reported.
 - No serious side effects reported with doses up to 1800mg daily.

- 
- Dose
 - Not established.
 - Studies use 600–1200mg daily.

Interactions(Theoretically):

- Moderate Interaction
- Be cautious with this combination
- Alpha-lipoic acid is an antioxidant.
- May decrease effectiveness of chemotherapy.
- But it is too soon to know if this interaction occurs.

- 
- May increase risk of hypoglycaemia with insulin and hypoglycaemics.
 - But more evidence is needed to know if this interaction is a big concern.

- May have additive effects with herbs causing hypoglycaemia :
- devil's claw, garlic, guar gum, ginseng, horse chestnut, psyllium.
- Herbs with hyperglycaemic potential:
- ginger, gotu kola may antagonize alpha-lipoic acid




Carotenoids

Tetraterpenoids

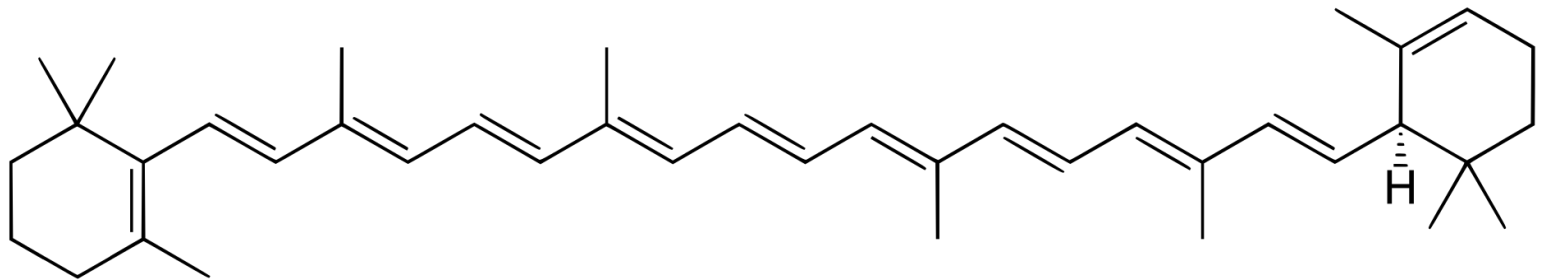
- Carotenoids are natural pigments found in plants, including fruit and vegetables, giving them their bright colour.

Constituents

- Identification of about 600 carotenoids
- Significant carotenoids in human nutrition:
- alpha-carotene, astaxanthin, beta-carotene, cryptoxanthin, lycopene, lutein and zeaxanthin.

- 
- Carotenoids :
 - containing oxygen eg. lutein and zeaxanthin, are known as xanthophylls.

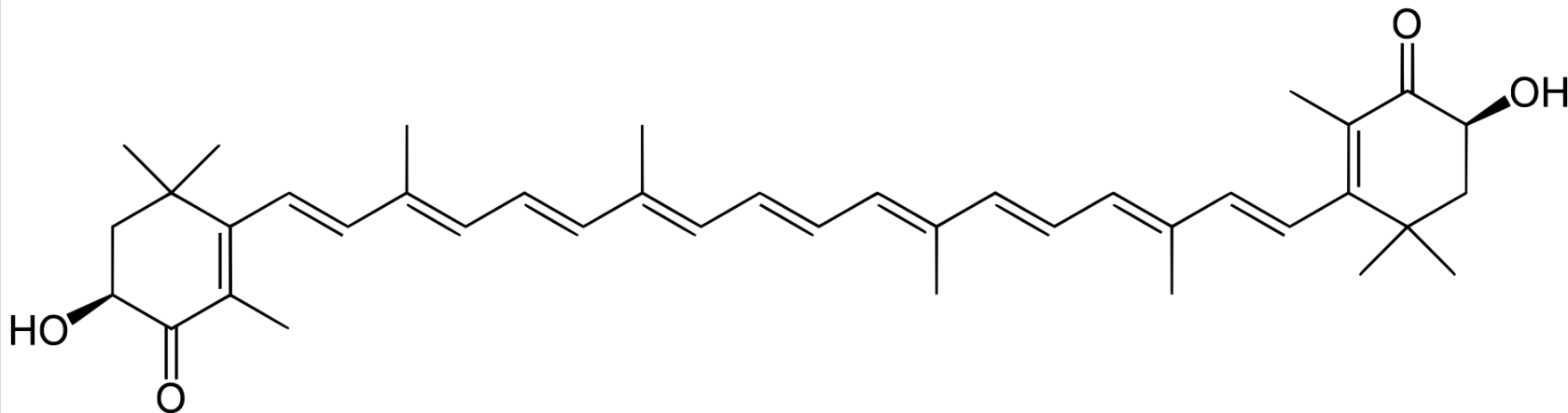
alpha-carotene



palm oil, maize, carrots and pumpkin.

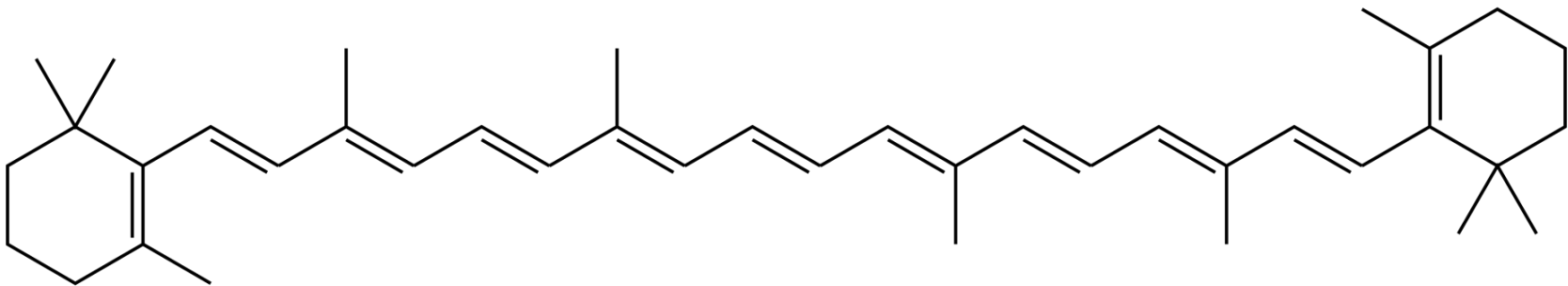
Astaxanthin

- in most red-coloured aquatic organisms. Astaxanthin, and other chemically related carotenoids, has also been found in a number of lichen species.



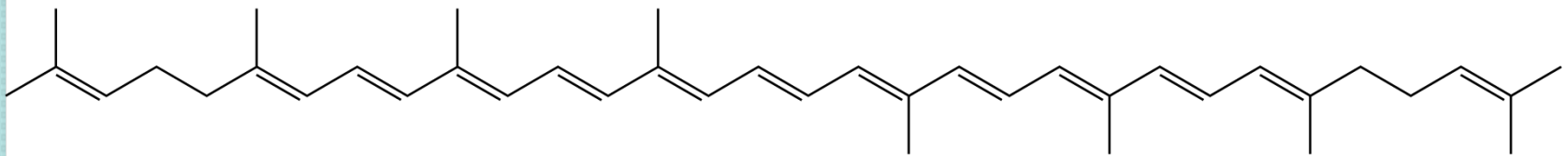
Beta-carotene:

- apricots, carrots, kale, mango, spinach.



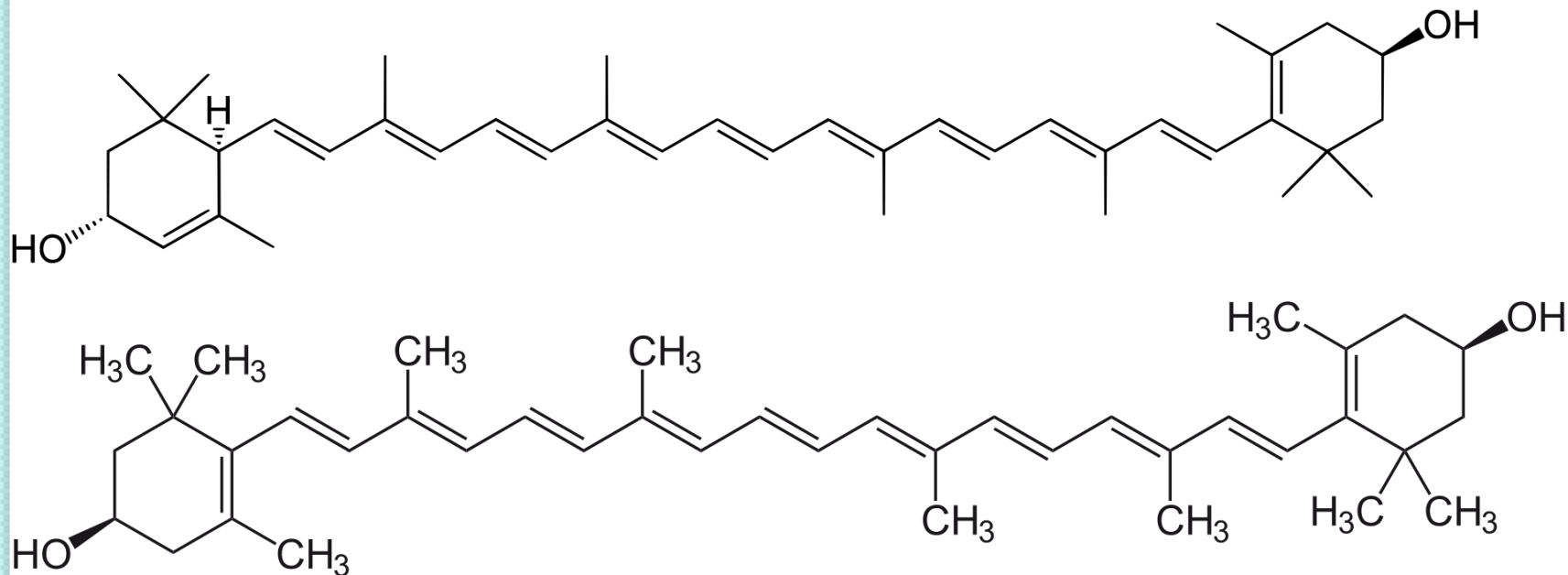
Lycopene

- red fruit, such as tomatoes (particularly cooked and pureed tomatoes), guava, watermelon, apricots, peaches and red grapefruit.



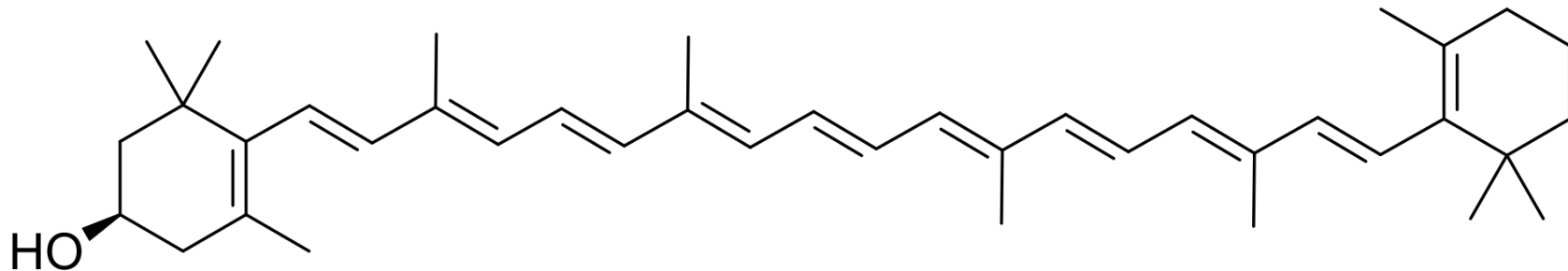
Lutein and zeaxanthin

- dark-green vegetables, red pepper and pumpkin



Cryptoxanthin

- mangoes, oranges and peaches



- 
- What is the role of carotenoids in plants??

Action

- Carotenoids act principally as antioxidants and on immune function.
- Some carotenoids (e.g. alpha-carotene, beta-carotene, cryptoxanthin) act as precursors for vitamin A.

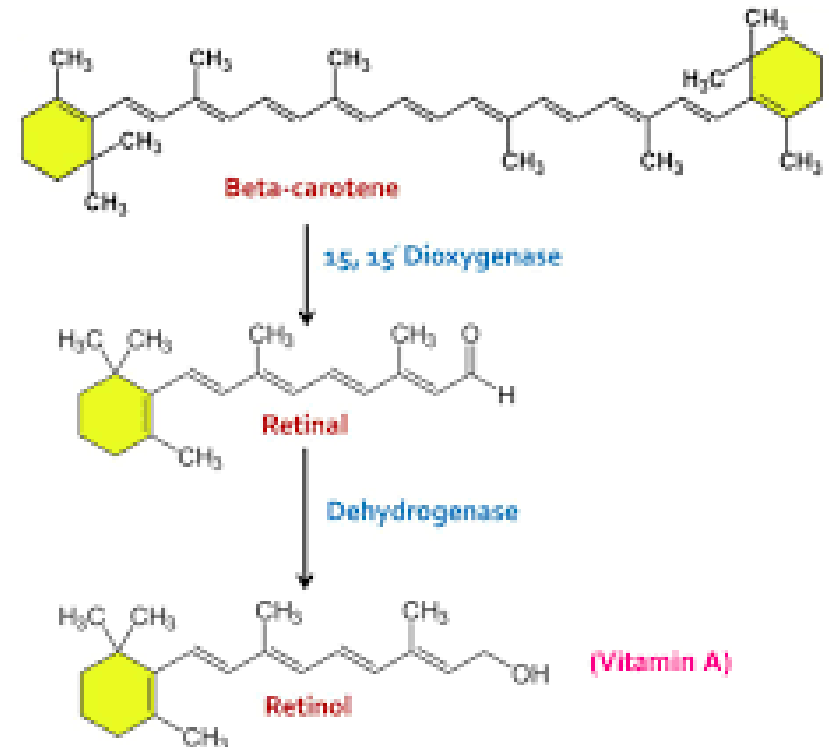
Possible uses (supplements)


- Cancer:
- Colon I
- Breast I
- Cervix I
- Lung I
- Prostate (lycopene) P
- Cardiovascular disease I
- Cataract (lutein/zeaxanthin) P

Bioavailability


- Beta-carotene:
- The efficiency of absorption is usually 20–50%, but can be as low as 10% when intake is high.


- The conversion of beta-carotene to retinol is regulated by the individual's vitamin A stores and the amount ingested.




- 
- conversion efficiency:
 - 2:1 at low intakes
 - 12:1 at higher intakes
 - On average:
 - 25% of absorbed beta-carotene appears to remain intact
 - 75% is converted to retinol

- **Precautions/contraindications**
- No problems have been reported when taken in appropriate amounts for certain medical conditions.
- Are not recommended for general use.
- High doses:
- can turn skin yellow or orange.(hypercarotemia).
- This is harmless and reversible


- 
- There is also concern that taking large amounts of a multivitamin plus a separate beta-carotene supplement increases the chance of developing advanced prostate cancer in men.

- 
- Before or after of Angioplasty:
 - Can interfere with healing
 - Don't use without the recommendation of healthcare provider.
 - History of asbestos exposure:
 - Might increase the risk of cancer
 - Smoking:
 - Might increase the risk of colon, lung, and prostate cancer


- 
- Pregnancy/breastfeeding
 - No problems reported, Likely safe.
 - Large doses of beta-carotene supplements are not recommended for general use

Interactions


- Medications used for lowering cholesterol (Statins)
- Niacin

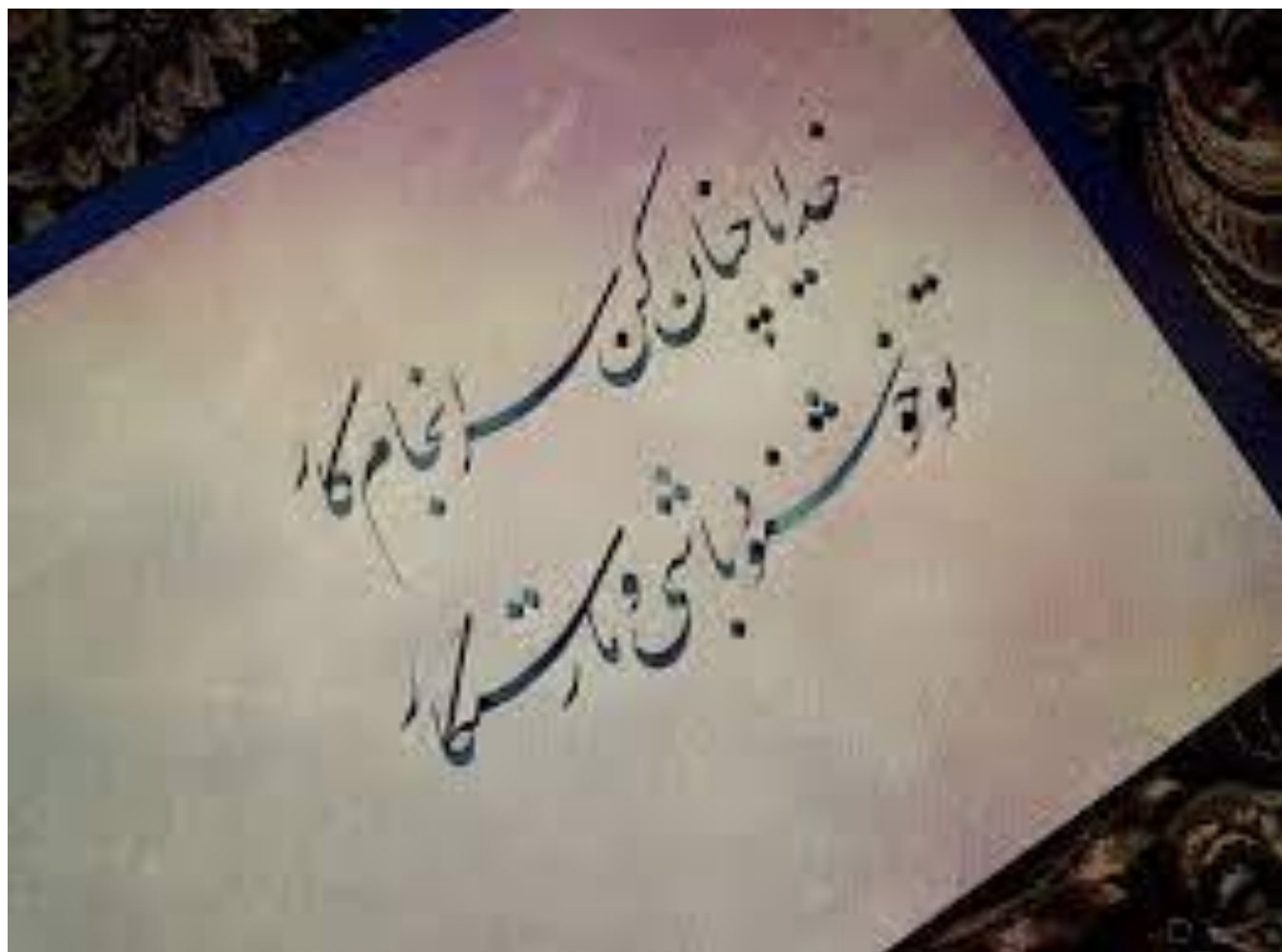
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- Dose
 - Beta-carotene, lutein, lycopene and mixed carotenoids are available in the form of tablets and capsules.
 - Beta-carotene should not be recommended as a single supplement

- Inherited disorder marked by sensitivity to light :
- Dosage is based on age
- Adults:
- 180- 300 mg/day
- age 1 to 4: 60-90 mg/day
- age 5 to 8: 90-120mg/day
- age 9 to 12 years: 120-150 mg/day
- age 13 to 16 years: 150-180mg/day

- 
- Preventing sunburn:
 - A specific product:
 - containing 24-25 mg of beta-carotene along with other carotenoids has been used for 12 weeks.

- Eye disease that leads to vision loss in older adults (age-related macular degeneration or AMD):
- 15 mg of beta-carotene
- 500 mg of vitamin C,
- 400 IU of vitamin E
- with or without 80 mg of zinc oxide
- daily.

- 
- Beta-carotene supplements are available in two forms.
 - Water-based
 - Oil-based
 - Studies show that the water-based version seems to be absorbed better.





GOD BLESS
you always