

Essential Fatty Acids

Shifa Ali (Registered Dietitian)

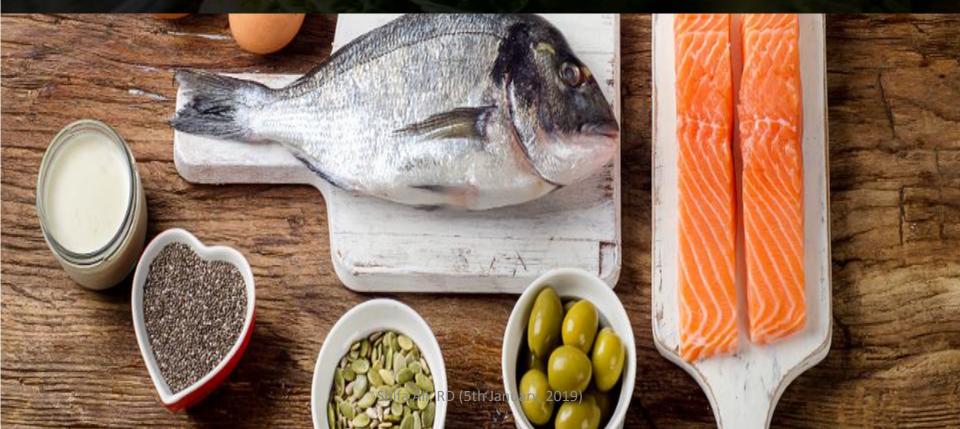
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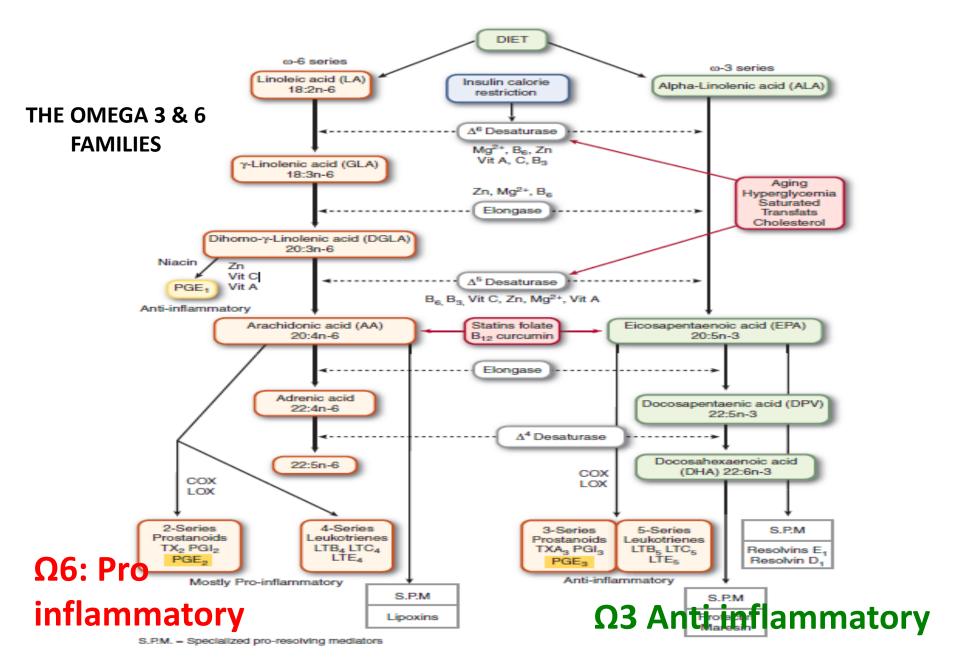


Linoleic Acid (LA) 18 carbon Omega 6 α-linolenic acid (ALA) 18 carbon Omega 3

Body cannot make these two fatty acids from scratch.

But it can make longer chain Omega 3 & Omega 6 if LA & ALA are provided through diet.

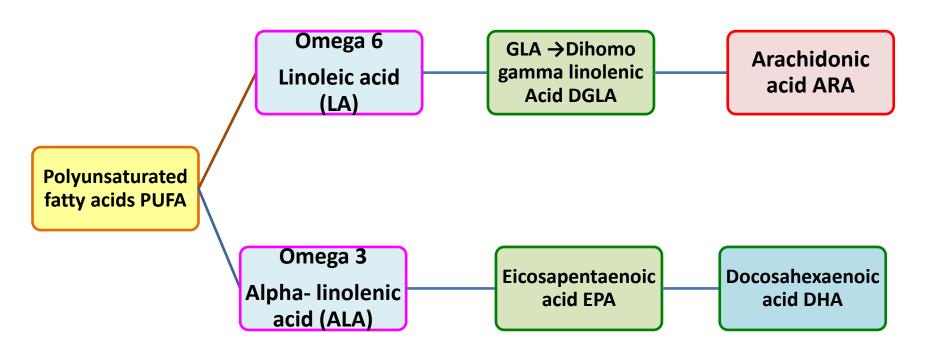
LA & ALA themselves are not used in body functions. They have to be converted to their longer chain family members to produce antiinflammatory or inflammatory effects eicosanoids, prostaglandins



It is the longer chain fatty acids

- (20:4 n-6) ARA Arachidonic Acid
- (20:5 ω-3) EPA Eicosapentaenoic Acid
- (22:6 ω-3) DHA Docosahexaenoic Acid
 that are essential, but if sufficient amount of
 shorter chain precursors (Linoleic acid &
 Alpha Linolenic acid) occur in the diet, they
 need not be supplied directly.

Metabolically the five primary eicosanoids GLA, DGLA, ARA, EPA, DHA collaborate and compete for shared enzymes in forming the prostaglandin groups

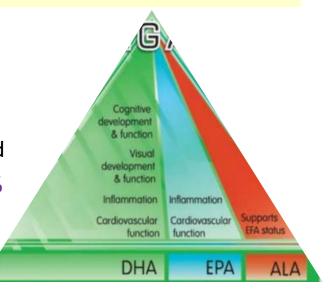


α – Linolenic Acid conversion to DHA is limitted!

1. One study suggested that only

~2 to 10% of ALA is converted to EPA or DHA,

2. and other studies found even less: Goyens et al. found an ALA conversion of ~7% for EPA, but only 0.013% for DHA



PMCID: PMC3262608

PMID: 22332096

3. Hussein et al. found

an ALA conversion of only **0.3% for EPA and <0.01%** for DHA.

<u>Adv Nutr.</u> 2012 Jan; 3(1): 1–7. Published online 2012 Jan 5. doi: <u>10.3945/an.111.000893</u>

Omega-3 Fatty Acids EPA and DHA: Health Benefits Throughout $\mathsf{Life}^{\underline{1}}$

Danielle Swanson, Robert Block, and Shaker A. Mousa

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Decreasing linoleic acid with constant alpha-linolenic acid in dietary fats increases (n-3) eicosapentaenoic acid in plasma phospholipids in healthy men.

Liou YA1, King DJ, Zibrik D, Innis SM.

High dietary intakes of LA(Ω 6) lead to reduced desaturation of $ALA(\Omega 3)$ due to competition between IA and AIA for D-6 desaturase, thus favouring increased tissue ARA (Ω 6) and reduced levels of the longer chain (n-3) fatty acids.

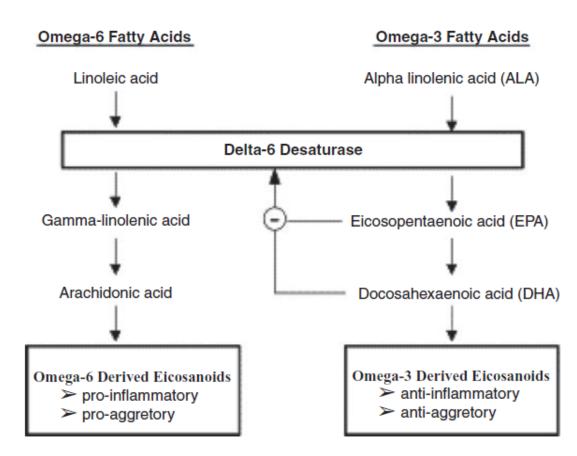


Figure 1 Metabolic pathway of omega-6 and omega-3 fatty acids. (Defilippis and Sperling, 2005).

What affects ALA conversion to EPA & DHA?

- •Diets with a high ratio of LA:ALA can suppress DHA synthesis in favor of inflammatory docosapentenoic acid (DPA).
- •Delta-6 desaturase is the enzyme responsible for synthesizing LCPUFA's from ALA(Ω 3) and LA(Ω 6). The activity of this enzyme can be reduced by

Factors reducing ALA (Ω 3) conversion to DHA (Ω 3)

- Aging
- Stress
- Diabetes
- Eczema
- Infections
- Hydrogenated fats
- Saturated fats
- Lack of vitamin & mineral cofactors
- Smoking, alcohol, caffeine

Bioavailability and Potential Uses of Vegetarian Sources of Omega-3 Fatty Acids: A Review of the Literature, Kate Lane et al. 2014 https://www.ncbi.nlm.nih.gov/pubmed/24261532

Inflammation—The Root of Chronic Disease

Asthma, Allergies, Bronchitis, COPD

Boswellia has been shown to stop the reactive inflammation response that creates asthma and allergy symptoms, and reduces inflammation in lung tissue.

Brain and Memory

Inflammation can damage brain cells, promoting
Alzheimer's disease and other cognitive problems.
Boswellia can increase neuronal volume and boost learning and memory.

Cancer and Tumor Growth

Inflammation alters the way cells divide and sets in motion the conditions for tumors to form and grow. By eliminating inflammation, you take away one of the major causes of cancer throughout the body.

Heart Disease

Chronic inflammation and oxidation is a frequent cause of heart diseases.



IBS, Irritable Bowel Disease

Inflammation in the digestive tract is responsible for the painful, unpredictable symptoms of many intestinal diseases, including autoimmune conditions. Boswellia stops inflammation triggers, reducing the incidences of the inflammatory "cascade effect" that makes these diseases so difficult to treat conventionally.

Joint Pain

Inflammation causes
pain and destroys joints.
Because boswellia stops
inflammation, it can help joints heal
faster and keep damage from getting
worse. Combined with curcumin, it has
been shown to relieve osteoarthritis
pain better than prescription drugs.

Inflammation doesn't just cause joint pain—it causes disease throughout the body, including cancer. Fighting inflammation effectively can make the difference between life and death. Boswellia fights inflammation across many pathways, including 5-LOX activation.

Shifa Ali, RD (5th January, 2019)

Optimum Omega 6:3 ratio



Ancestral humans consumed 1:1



↑consumption
of processed
foods rich in
vegetable oils
& animal
derived fats



The ratio reached 15:1. Currently it is around 20:1 in American diets



At this higher intake, metabolism of omega 6, and consequently, inflammation, may be favoured

Simopoulos AP. Importance of the omega-6/omega-3 balance in health and disease: evolutionary aspects of diet. World Rev Nutr Diet. 2011;102:10-21. https://www.ncbi.nlm.nih.gov/pubmed/21865815

Optimum Omega 6:3 ratio



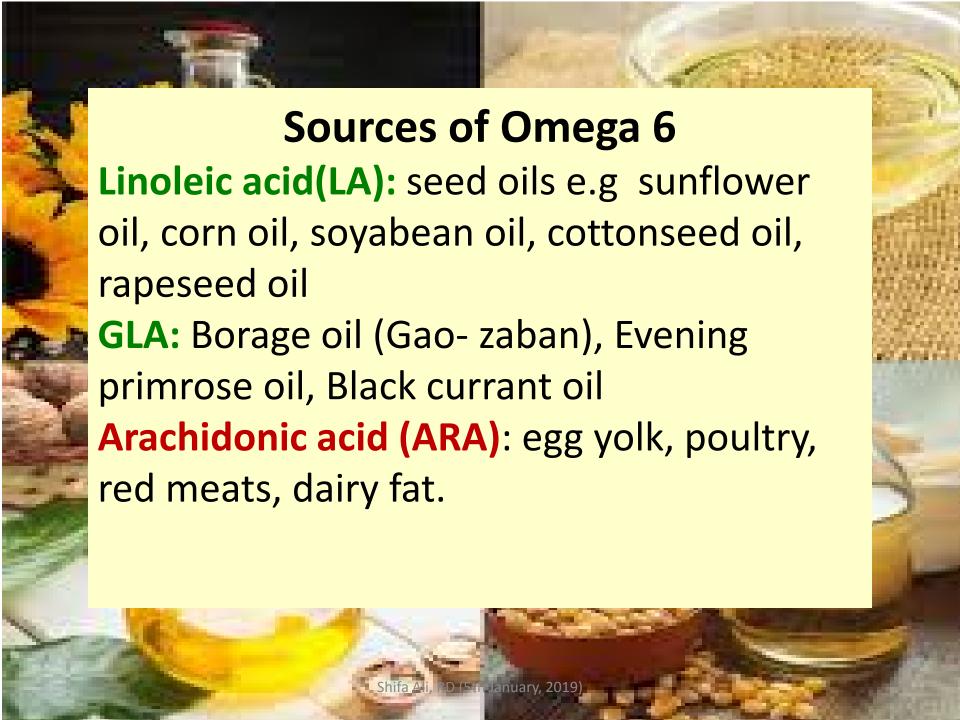
a ratio of 4:1 or lower has been suggested as optimal for human health.

For every 10% increase in LA (Ω 6), EPA(Ω 3) decreased by 0.64 g/100 g fatty acids



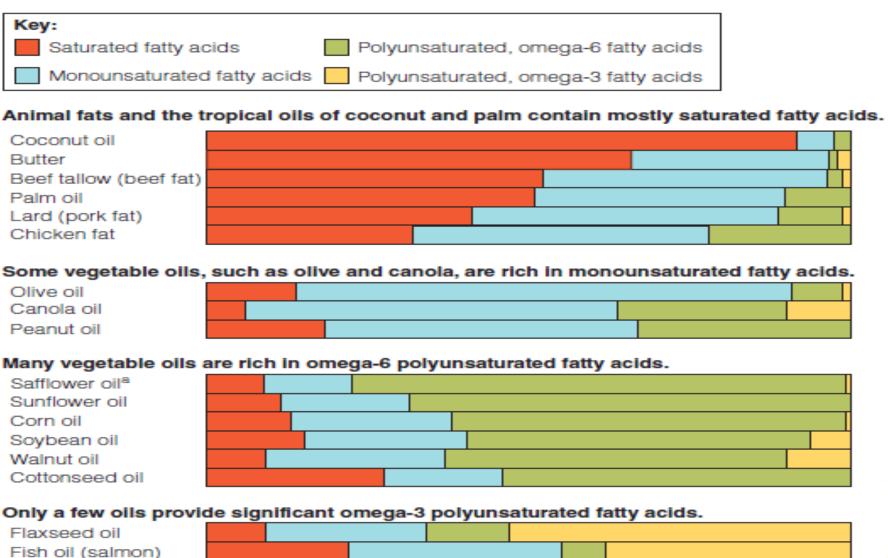
J Nutr. 2007 Apr;137(4):945-52.

Decreasing linoleic acid with constant alpha-linolenic acid in dietary fats increases (n-3) eicosapentaenoic acid in plasma phospholipids in healthy men.









^{*}Salad or cooking type over 70% linoleic acid.

Understanding Nutrition 14th ed. (2015). Whitney & Rolfes

Plant oils termed as Tropical oils

- Coconut oil
- •Palm oil
- Palm kernel oil
- Partially hydrogenated oils(PHO) containing trans fats

(Dietary Guidelines for Americans 2015-2020)

fats & should be considered as



Solid Fats

Food Sources: Instant noodles, breakfast cereals, nutella spreads, biscuits, cookies, chocolate, coffee creamers, margarine etc.





INGREDIENTS

Skimmed milk, Vegetable Oils (palm olein Tow erucic rapeseed oil, coconut oil sunflower oil), Maltodextrin, Lactose Sucrose, Minerals, Soya Lecithin, Fish Oil, Vitamins, Taurine, Inositol, Probiotics [Lactobacillus reuteri culture (DSM 17938*)]

اجزائة تركيبي: سكمد ملك، وتحييل آئلز، (يام اولين، الواروسك ريب سيرة كل ،كوكونت آئل ، س فلا ورآئل) مالنودْ مكسيْن ،ليكورْ ،سُكر وز ،منرلز ،سويليسيتهن ،فش آئل ، وٹامنز،ٹائرین،انوسیٹول،پروہائیوٹکس [اليكو بائيسليس روٹري كلير (*DSM 17938)]

* Under License from BioGaia AB

Average Composition/Ar	nalysis	Per 100 g of powder	Per 100 ml of prepared formula
Energy	Kcal	481	67
Fat	q	21.6	3
Linoleic acid	9	3.5	0.5
g-linolenic acid	mg	430	60
U-miordine dela		44.7	6.5

Powder Tea Whitener INGREDIENTS:

Milk Solids, Sugar, Vegetable Fat, Stabilisers (INS 339,451) & Soya Lecithin

- Product in this pack contains Sova Lecithin
- Contains added sugar



Wall's کمپنی کی براڈ کٹ کھویا قلفہ میں کوئی کھویایا قلفہیں ہے۔

پیویجیٹل فیٹ(Vegetable Fat)سے بنافروزن ڈیزرٹ ہے۔ ٹی وی پر چلنے والے کمرشلزعوام کے لیے گمراہ کن ہیں عوام الناس سے گزارش ہے کہ بہتر غذائیت کی بنایرا پنے بچوں کوآئس کریم کھلائیں۔



اطلاع برائے عوام الناس

حکومت یا کستان کے حالیہ جائزے کے مطابق 44 فیصد بچوں میں نشو وقما کی تکی يانى كى بـ62 فيصد بحول يس آئزن اورفو لك ايسد كى مو كى بــمزيدىيك بچوں کی دماخ کی 90 ہے 95 فیصد نشو ونما5 سال عمر تک مکمل ہوجاتی ہے دماغی

نشو ونما کے لئے خالص دود دواور کھیں نہا ہیں صروری ہے اس ہے جسمانی اور د ماغی عضلات تشو ونمایا نے ہیں ۔لہذ وعوام الناس یرز ور دیا جاتا ہے کہ اینے بچوں کے لئے خالص دودھ اور تکھن کا استعمال یکنٹی بنائمیں۔

ان حقائق ك يشين نظر عوام كو بتايا جار باب كر بليو بينز مارجرين ك نام كى يراد ك Vegetable Fat ينائي كى ب جوند الونكسن عداورنة كسن كانتبادل-

ا ہے مکھن جور ربیوں کومت کھلا کیں کیونکہ اس کے کھانے سے بچوں کی وہنی وجسمانی نشو ونمایہ کوئی مثبت الرفہیں پڑے گا۔

تورالا مين مينتكل ۋائر <u>ك</u>ىشر چىزل ه خياب فو دُ التفار في

Sandwich Biscuits with Chocolate Flavored Filling.

Wheat Flour, Sugar, Vegetable Fat Uncliding Palm Oil, Soyabean Oil & Cottonseed Oil), Defatted Cocoa Powder, Maize Starch, Invert Sugar, Salt, Sodium Fe EDTA Raising Agents: Sodium Bicarbonate (E500), Ammonium Bicarbonate (E503), Sodium Meta bi Sulphite (E223), Soya Lecithin (E322), Whole Milk Powder, Vanilla and Chocolate Flavor.

Centains Manay (Gluten), Sova and Milk. May Contain Traces of Egg.

INGREDIENTS:

Potatoes, palm oil, masala flavour [natural flavouring, (onion powder, garlic powder, chili powder, coriander powder, cumin owder, black pepper, tomato powder, parsley, paprika extract (E160c)) sugar, citric acid (E330), anticaking agent (E551), flavour enhancers (E627, E631-from plant)] and salt.

Contains traces of peanut

ر 🐠 🗼 پنجاب فو ڈانفار ٹی ،حکومت پنجاب

فارمولا دودھ سے بچوں کی مڈیاں ، د ماعی سفو ونمامتا تر

جبیبل فیٹ اورخشک دودھ میں قدرتی غذائیت نہ ہونے سے قد کم رہنے لگے

الرات سامنےآئے ہیں، بدسمتی سے یا کتان میں فارمولا دوده كى فروخت كار جحان فروغ يذير ب، ۋاكم بچول كىلتے انفین ملک تجویز کررہے ہیں۔صارفین کے تحفظ کیلئے کام كرنيوالي محن بھٹی نے بتایا كه یاؤڈر بنانے كيلئے كريم نکال کر دودھ خشک کیا جاتا ہے اور بعد میں وجیٹبل فیٹ شامل کی جاتی ہے جو ہڈیوں کو متاثر کرتی ہے۔ پنجاب فوڈ اتھارتی کے حکام نے رابطہ پر بتایا کہ فارمولا دودھ بیجنے والی كمينيول كيخلاف كارروائي كافيصله كركيا كمياب اورقانون سازی کیلئے سفارشات مرتب کی جارتی ایں۔

لاہور(صبغت اللہ چودھری)شر خوار ول کو د ہے جا یوالے فاصولا ملک کے باعث بچوں کی ہڈیوں اور د ماغ ك نشووتما متاثر مونے كا انكشاف مواب، و يجيئيل فيك اورختک دودھے تیار ہو نیوالے یاؤڈرمیں قدرتی غذائیت نہونے کے باعث 5ے 15 سال کی عمرے 45 فیصد بچوں کے قدم رہ گئے ہیں، عالمی ادارے کی راورٹ کے بعدمتعلقه ادارول كوجهي موش آگيا، فارمولا ملك بنانيوالي كمپنيوں كيخلاف كريك ڈاؤن كافيصله كرليا كيا۔ غذائي امرين كاكبنا بك ياؤوردوده في بيون كانثوونما يرمنفي



INGREDIENTS:

VEGETABLE FAT, MILK SNF, SUGAR MILK FAT AND STABILIZERS. صیف چائے میں استعال کے ہے

یہ کوں کے لیے دووھ کا مُشاول نہیں ہے

عَدَانُ اجراء	100 ml 3	30 ml ↓√3
ENERGY	346 KJ / 83 kCal	104 KJ / 25 kCal
FAT	6.6 g	2.0 g
PROTEIN	1.79	0.5 9
CARBOHYDR	ATES 4.2g	1.3 g
MINERALS	0.49	0.19
	P * 7	



engro foods Manufactured & aseptically packed by: ngro Foods Ltd., 5th Floor, Herbour Fron illding, Black 4, Clifton, Karachi, Pakisto







NUTRITION INFORMATION	Avg / 100g	2001	% GDA* per portion	-
	494	161	15%	
Energy (kcal)	28	9.1	20%	
	12	3.9		3
of which saturates (g)	37.5	12.2	5%	-r
Carbohydrates (g)	37.5	12.2	14%	- 1
of which sugars (g)	0	0	8%	_
Fiber (g)	23	7.5	34%	
Protein (g)	0.38	0.12	9%	
Sodium (g)	4.		%DRI**	
	4.5	1.5	15%	
Linoleic Acid (g)	(mm) 54	0 176	20%	
Alpha-Linclenic Acid	75		24%	
Iron (mg)	- F	2.9	29%	
Zinc (mg)		1 1.2	24%	
Vitamin A (IU)	18	00 585	44%	-
Vitamin D (IU)		40 78	13%	
Vitamin E (IU)		.5 1.8	17%	
Vitamin C (mg)		55 21	85%	
Vitamin B1 (mg)		0.1	16%	
Vitamin B2 (mg)		0.3	54% 22%	
Niacin (mg)		0.4 0.12		
Vitamin B6 (mg)		135 44	1000	-
Felic acid (µg)				
The same of the same of	te of Medicini Pack contail	age 8 year-old chili (4-8 years), Food 8 E, National Acader ns 28 portions. I for children of dif	nies.	cal).

It is now common for food products to boast that they have added omega 3s. But the amount of omega 3s they contain may be minimal, so check the label. They may contain the ALA form of Omega 3s, which hasn't yet shown the same benefits as EPA & DHA. Still it is better to add Omega 3 than overload with omega 6



Research

Re-evaluation of the traditional diet-heart hypothesis: analysis of recovered data from Minnesota Coronary Experiment (1968-73)

BMJ 2016; 353 doi: https://doi.org/10.1136/bmj.i1246 (Published 12 April 2016) Cite this as: BMJ 2016;353:i1246

Conclusions Available evidence from randomized controlled trials shows that replacement of saturated fat in the diet with linoleic acid effectively lowers serum cholesterol but does not support the hypothesis that this translates to a lower risk of death from coronary heart disease or all causes. Findings from the Minnesota Coronary Experiment add to growing evidence that incomplete publication has contributed to overestimation of the benefits of replacing saturated fat with vegetable oils rich in linoleic acid.

Arachidonic Acid (ARA) Omega 6, Good or bad?



- Arachidonic acid can become conditionally essential esp for infants
- ARA increases healing blood flow and inflammation.
- But in chronic disease, ARA can get stuck in an elevated state and continue to damage tissue and encourage degeneration.
- ARA can become dangerously elevated, especially when dietary intake has deficient levels of omega 3 ALA, EPA and DHA to act as an ARA counterbalance.
- The United States and most industrialized countries' populations live with high ARA levels because of low intake of omega 3 oils and large intakes of highly processed PUFAs and trans fats.

So why Arachidonic Acid (n-6 ARA) is being added to infant formulas?

- Most abundant fatty acid in the brain, present in similar quantities as DHA.
- Critical for infant growth, brain development, and health.
- Balancing the amounts of ARA and DHA is important as too much DHA may suppress the benefits provided by ARA. Both ARA and DHA have been added to infant formulas and followon formulas for more than two decades.
- ARA & DHA are naturally present in human milk
- Without the provision of preformed ARA in human milk or infant formula, the growing infant cannot maintain ARA levels, from synthetic pathways alone, that are sufficient to meet metabolic demand.

The Essentiality of Arachidonic Acid in Infant Development, Hadley et al. 2016



Omega 3 ALA from flax seeds, walnuts & chia seeds are not effectively converted to the useful

Omega 3s EPA & DHA

ALA → EPA → DHA

Therefore it is important to incorporate the EPA and DHA directly

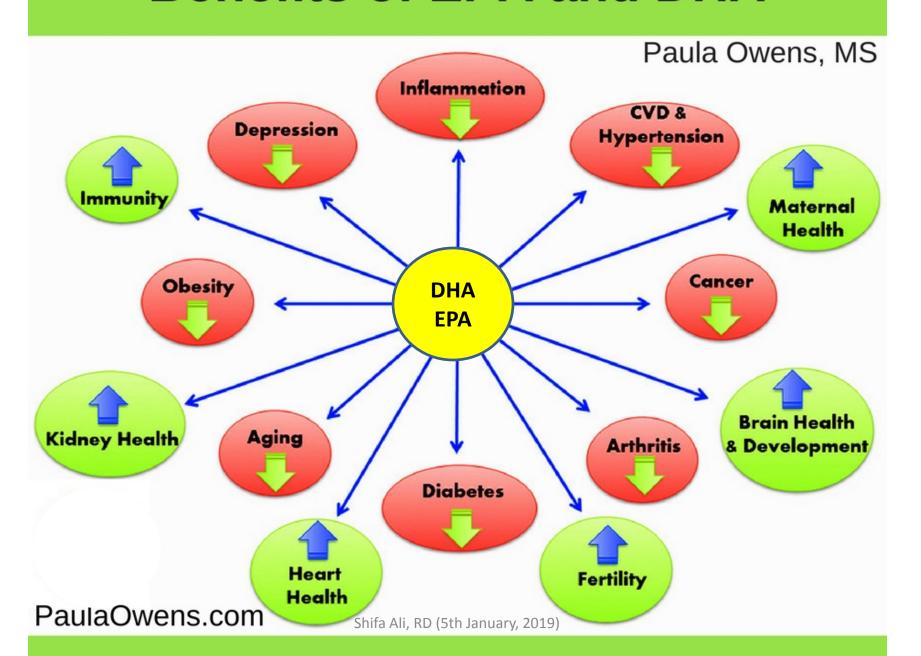


- Fish
- Cod liver oil
- •Fish oil
- Algaesupplements



(Krause's Food and the Nutrition Care Process, 14th Ed., 2017)

Benefits of EPA and DHA



Children with autism may need additional essential fatty acids.

It has been suggested that a lack of essential fatty acids (EFAs) is a possible cause of hyperactivity in children. It is more likely the result of varying biochemical influences. These children have a deficiency of EFAs because they cannot metabolize linoleic acid normally, they cannot absorb EFA effectively from the intestine, or their EFA requirements are higher than normal. Older studies showed lower levels of docosahexaenoic acid (DHA) and arachidonic acid (ARA) in children with hyperactivity, and this has been replicated in more recent studies (Burgess et al., 2000).

DHA(Ω 3) in human milk

- Human milk contains LA(n6), ALA(n3) and also ARA(n6) & DHA(n3).
- Mean intake of breast milk at age 1 mo provides 250 mg long-chain n3 fatty acids. Egg yolk as a source of long-chain polyunsaturated fatty acids in infant 12 Artemis P Simopoulos and Norman Salem, Jr
- Breast milk DHA concentration is influenced by DHA in the mother's diet.
- The lowest values (0.06% to 0.22%) are found in milk from mothers with little or no preformed sources of DHA (eg, fatty fish) in their diets and the highest values (1%) are found in milk from mothers who consume oily fish products daily.
- The breastfed infant obtains DHA through maternal milk when the mother eats sufficient quantities of foods containing DHA. If the exclusively breastfeeding mother is not consuming fish or DHA supplements, a DHA supplement can be given to the infant. Most infant formulas are fortified with DHA.

http://milkgenomics.org/article/much-dha-human-milk/ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5273852/ Shifa Ali, RD (5th January, 2019)

Supplementing lactating women with flaxseed oil does not increase docosahexaenoic acid in their milk



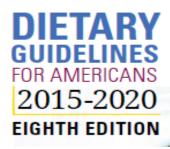
Cindy A Francois, Sonja L Connor ▼, Linda C Bolewicz, William E Connor

The American Journal of Clinical Nutrition, Volume 77, Issue 1, 1 January 2003, Pages 226–233, https://doi.org/10.1093/ajcn/77.1.226

Published: 01 January 2003 Article history ▼

DHA and EPA levels were significantly higher in breast milk from women supplemented with fish oil than in samples from the control group

The effect of supplementation with fish oil during pregnancy on breast milk immunoglobulin A, soluble CD14, cytokines levels and fatty acid composition. Dunstan JA et al., 2004



- ■Fish 8 ounces per week for general population
- ■250 mg per day of EPA and DHA, is associated with reduced cardiac deaths among individuals with and without preexisting CVD.
- ■Similarly, 8 oz per week consumption by women who are pregnant or breastfeeding seafood choices that are sources of DHA is associated with improved infant health outcomes.



- ■At least two servings per week of fatty fish (3.5 0z = 1 ser)
- ■AHA also recommends 2000 to 4000 mg EPA+DHA for people who are trying to lower their triglyceride levels. Supplementation of more than 3000 mg per day should be done only under the supervision of a physician since high intakes of omega 3 have caused excessive bleeding in many individuals.

Shifa Ali, RD (5th January, 2019)

Adequate Intakes for Ω 3 fatty acids			
Age (years)	Males (g/day)	Females (g/day)	
1-3	0.7	0.7	
4 – 8	0.9	0.9	
9 – 13	1.2	1	
14 – 18	1.6	1.1	
19 +	1.6	1.1 (1100 mg)	
Pregnancy		1.4 (1400mg)	
Lactation		1.3	

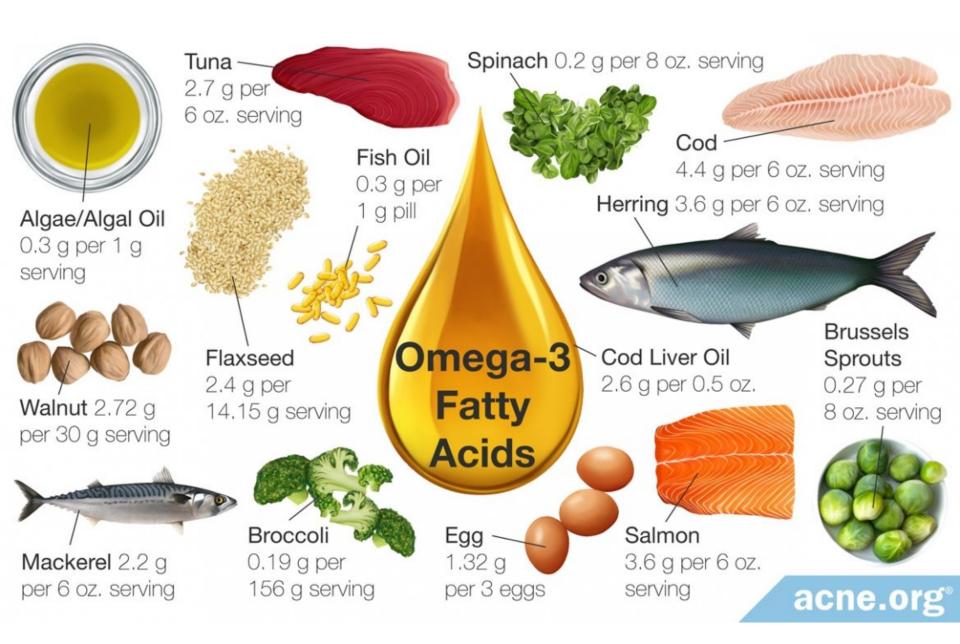
Adequate Intakes for Ω 6 fatty acids			
Age (years)	Males (g/day)	Females (g/day)	
1-3	7	7	
4 – 8	10	10	
9 – 13	12	10	
14 – 18	16	11	
19 +	17	12	
Pregnancy		13	
Lactation		13	

Krause's Food & the Nutrition Care Process, 14th Ed (2017)

If a 4 oz serving of salmon provides 3.6 g Omega 3, consuming 8 oz per week(as per AHA guidelines) will provide how many gms or mgs per day?

WHO: n-3 PUFAs: 1 to 2% of energy/day AHA: n-6 PUFAs 5 to 10% of daily calories

Global Recommendations for EPA and DHA Intake (Rev 16 April 2014)



Food	ALA (g)	DHA +EPA (mg)
Flaxseed/linseed oil(1 Tbsp)	10.0	
Flaxseeds/Linseeds, 1 Tbsp (14g)	3.5	
Chia seeds, 1 Tbsp (15g)	2.7	
Walnuts, 10 nut halves (30g)	1.9	
Canola oil, (1 Tbsp)	1.7	
Seaweed, nori, dried, (3 sheets)	0.01	135
Omega-rich eggs, (1 medium)*	0.52	180
Eggs, cooked, (1 medium egg)	0.08	27
Fish Oil 1tsp (5ml)		1200-1800
Cod liver oil 1tsp (5ml)		800-1000
Chinook Salmon 4 ounces		3600 mg
Tuna 4 ounces		970mg

[•]AUSNUT – Australian Food and Nutrient Database, FSANZ 2007 and Nutrition Informational Panels on Food Products.

https://flaxcouncil.ca/wp-content/uploads/2015/03/FlxPrmr_4ed_Chpt1.pdf

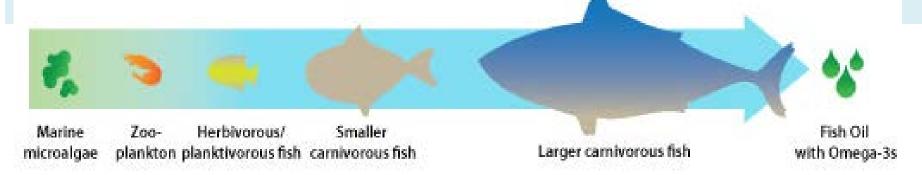
Shifa Ali, RD (5th January, 2019)

^{•&}quot;Description and Composition of Flax "

[•]Krause 2017

^{•*}Ferrier LK, Caston LJ, Leeson S, Squires J, Weaver BJ, Holub BJ. Alpha-Linolenic acid- and docosahexaenoic acid-enriched eggs from hens fed flaxseed: Influence on blood lipids and platelet phospholipid fatty acids in humans. Am J Clin Nutr. 1995;62:81-6.

Fatty fish takes its Omegas from somewhere else!!



- Zooplankton Plankton are organisms drifting in oceans, seas, and bodies of fresh water. zooplankton play a key role in aquatic food webs. They are rich in longer chain omega 3.
- Algae are rich sources of DHA and EPA



Farmed Vs Freshwater fish



Farmed Fish VS Freshwater Fish

- Freshwater fish can contain more omega 3 because they feed on a wide variety of zooplankton and algae
- Farmed fish may have limited feed variety & may be raised with contaminated pesticide laden water
- Modern aquaculture produces fish that contain less omega-3 fatty acids than do fish grown naturally in the ocean, rivers and lakes. (Lower ratio of n-3 to n-6 fatty acids in cultured than in wild fish.van Vliet T, Katan MB Am J Clin Nutr. 1990 Jan; 51(1):1-2.)



Fish in Pakistan

Palla



Mahsheer

Non Oily fish

- Mahasheer (National Fish of pakistan)
- Rahu (230mg Ω3/ 100g)*
- Catla
- Pomfret
- Baam (eel)
- Sole

Oily fish

- Palla
- Trout
- Rainbow trout
- Snapper (heera)
- Salmon (rawas machli)
- Sardine
- Tuna (imported canned)





11511



^{*}Nutritional aspects and seasonal influence on fatty acid composition of Carp (labeo rohita) from the indus river, Pakistan. Memon, Talpur & Bhangaer (2010)

	Fish specie	Local name	DHAmg/ 100g	EPAmg/ 100g	Total EPA+DHA
1.	Tenualosa ilisha	Palla machli	934	305	1240
2.	Trichiurus lepturus	Longhead hairtail	567	203	770
3.	Sardinella loniceps	Lonar (sindhi) Indian oil sardine	534	937	1472
4.	C. madrasensis	Oysters	383	377	760
5.	G. chapra	Chapila Indian river shad	342	-	342
6.	O. mykiss	Rainbow trout	224	81	306
7.		Salmon Indian salmon (Rawas)	700 - 1400	400	1800
8.		Sardine	509	470	979
9.		White snapper (heera)	371	244	615
10	Labeo rohita	Rahu			231

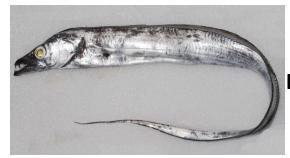
[•]DHA and EPA Content and Fatty Acid Profile of 39 Food Fishes from Indiahttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC4989070/

[•]https://health.gov/dietaryguidelines/dga2005/report/HTML/table_g2_adda2.htm

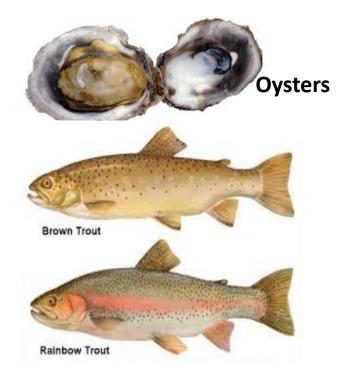
[•]Nutritional aspects and seasonal influence on fatty acid composition of Carp (labeo rohita) from the indus river, Pakistan. Memon,

Local oily fish Gallery





Long head hair tail

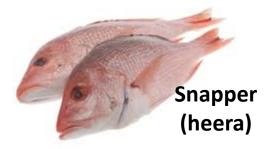




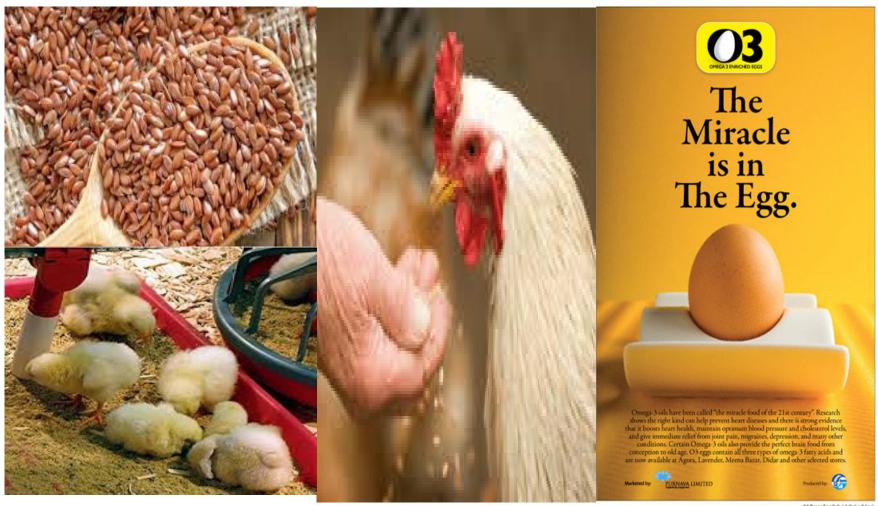
Lonar(sindhi) Indian oil sardine



Chapila (indian river shad) small fish



Omega 3 eggs????



03 Press English (3 Col x 8 Inc)

Feed your hen flaxseeds (ALA) & get DHA enriched eggs!

- Laying hens can covert ALA to DHA. (Burdge and Calder, 2006;
 Zivkovic et al., 2011; Gregory et al., 2013).
- By enriching the chicken feed with fishmeal or flaxseed, the ratio of omega-6:omega-3 decreased to 6:6 and 1:6 respectively. An Increase in the Omega-6/Omega-3 Fatty Acid Ratio Increases the Risk for Obesity Artemis P. Simopoulos
- To directly increase the amount of DHA, fish oil can be used in poultry feed or indirectly by increasing the levels of precursor ALA by feeding flaxseed (Jiang and Sim, 1993, Milinsk et al., 2003, Sparks, 2006).
- Egg yolk total omega-3 fatty acid (ALA, EPA, and DHA) concentration increased linearly as oil % age increased for flaxseed oil and milled flaxseed in feed.

Comparative omega-3 fatty acid enrichment of egg yolks from first-cycle laying hens fed flaxseed oil or ground flaxseed. June 2017, https://doi.org/10.3382/ps/pew462

TABLE 3-2 Fat-Oil Dietary Intake Survey Fats and Oils Please indicate how many times PER WEEK you eat the following fats/oils. OMEGA 9 (stabilizer) Almond Oil Olives ~50% of daily fat calories Almonds/Cashews Olive Oil Sesame Seeds/Tahini Oleic Fatty Acid Almond butter Hummus (tahini oil) Avocados Macadamia Nuts Peanuts Peanut butter (natural/soft) Pine Nuts Eggs (whole), organic (AA) OMEGA 6 (controllers) Evening Primrose (GLA) Essential Fatty Acid Family Meats (commercial) (AA) Black Currant Oil (GLA) ~30% of daily fat calories Meats (grass-fed, org) (AA) Borage Oil (GLA) Brazil nuts (raw) Hemp Oil LA-GLA-DGLA-AA Pecan (raw) Grapeseed Oil Sunflower Seeds (raw) Hazelnuts/Filberts (raw) Hemp Seeds Pumpkin seeds (raw) Fish Oil capsule:↑DHA OMEGA 3 (fluidity/communicators) Flax Oil Essential Fatty Acid Family Fish Oil capsule: ↑TEPA UDO's DHA Oil ~10% of daily fat calories Fish (salmon/fin-fish) Algae Greens Powder w/algae Fish (shellfish) $ALA \rightarrow EPA \rightarrow DHA$ Flax seeds/meal Chia seeds BENEFICIAL SATURATED (structure) Coconut Oil Meats, grass-fed ~10% of daily fat calories Butter, organic Wild game Short Chain/Medium-chain Triglycerides Ghee (clarified butter) Poultry, organic Dairy, raw & organic Eggs, whole organic DAMAGED FATS/OILS (promoting stress to Doughnuts (fried) Margarine cells & tissues) Should be <5% (try to avoid) Reg. vegetable oils (corn, sunflower, canola) Deep-fried foods Trans Fats Mayonnaise (Commercial) Chips fried in oil Acrylamides Hydrogenated Oil (as an ingredient) Regular salad dressing "Imitation" cheeses Peanut Butter (JIF, etc) Odd-Chain Fatty Acids VLCFA/damaged Roasted nuts/seeds Tempura Products with hydrogenated fats

What is erucic acid

INGREDIENTS Skimmed milk, Vegetable Oils (palm olein, low erucic rapeseed oil, coconut oil. sunflower oil), Maltodextrin, Lactose, Sucrose, Minerals, Soya Lecithin, Fish Oil, Vitamins, Taurine, Inositol, Probiotics [Lactobacillus reuteri culture (DSM 17938*)]

What is erucic acid



A monounsaturated omega-9 fatty acid, present in the oil-rich seeds of rapeseed and mustard.



Present in rapeseed & mustard :high levels of erucic acid (over 40% of total fatty acids). Canola (cultivated for food use) a genetically modified breed of rapeseed, contain below 0.5%. Low erucic acid rapeseed oil is canola.



Tests on animals show that ingesting oils containing erucic acid causes heart lesions & nutritional deficiencies in rats.

INGREDIENTS Skimmed milk, Vegetable Oils (palm olein, low erucic rapeseed oil, coconut oil, sunflower oil), Maltodextrin, Lactose, Sucrose, Minerals, Soya Lecithin, Fish Oil, Vitamins, Taurine, Inositol, Probiotics (Lactobacillus reuteri culture (DSM 17938*))

The main contributors to erucic acid exposure in the diet are pastries, cakes and biscuits. For infants, infant formulae is the main source.

https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/erucic-acid Shifa Ali, RD (5th January, 2019)

Studies on health effects of mustard oil have been conducted in India, which had conflicting results.

CHD history was associated with higher relative consumption of mustard oil than ghee and CHD is positively correlated with increased mustard oil intake. Comparison of Mustard Oil and Ghee Consumption on the History of Coronary Heart Disease in Urban Population of India https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5121705/

Use of mustard oil, which is rich in α -linolenic acid (6-10%), was associated with a lower risk than was use of sunflower oil. (Canola has 11%ALA)

Rastogi T, Reddy KS, Vaz M, et al. (April 2004). "**Diet and risk of ischemic heart disease in India**". Am. J. Clin. Nutr. **79** (4): 582–92. PMID 15051601

US, EU, Canada banned edible mustard oil.

FDA in 2011: "Expressed mustard oil is not permitted for use as edible vegetable oil. It may contain 20 to 40% erucic acid, which has been shown to cause nutritional deficiencies and cardiac lesions in test animals."

https://www.accessdata.fda.gov/cms_ia/importalert_89.html

Take Home Message: Time for an oil change



5 tsp oils per day are enough to meet essential fatty acid needs. The body needs a balance of each Essential Fat within the Omega-3 and Omega-6 families



Less intake of vegetable oils high in omega-6 fatty acids, to oils high in omega-3s (flax, nuts, chia, canola), and high in monounsaturated oils such as olive oil,



Increasing fish intake to 2–3 times per week, while decreasing meat intake



Limit intake of processed and deep-fried foods containing trans fats which can reduce the conversion of ALA to EPA and DHA https://www.pennutrition.com/docviewer.aspx?id=11713

Take Home Message: Optimize Omega 3 intake

- Add ground flaxseed to foods such as hot or cold cereal or yogurt.
 Pregnant women should limit their intake to occasional. As safety levels of lignans have not been established foe pregnancy.
- Eat walnuts. Add to salads, cereals, baking.
- Use flaxseed oil or canola oil in salad dressings.
- Consider using omega 3 fortified products.
- Substitute ¼ cup ground flaxseed for ¼ cup flour in bread, pizza dough, cake, cookie recipes
- Replace 1 egg with 1Tbsp ground flaxseed and 3Tbsp water in recipes.
- Consider taking a DHA supplement, particularly if you are pregnant or breastfeeding - aim for 100-300mg/day.
- Canned fish can be included such as tuna, sardines & salmon.

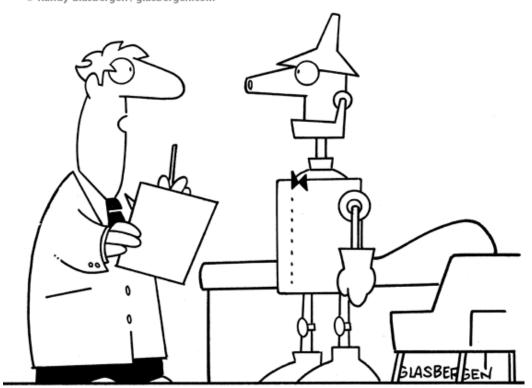


[➤] https://www.pennutrition.com/docviewer.aspx?id=11713
➤ Krause's Food & the Nutrition Care Process, 14th Ed (2017)

Time for an Oil Change

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"I want you to switch from motor oil to omega-3 fish oil."