ADËEVA *NATURE'S ESSENTIAL OILS*

Understanding Essential Fats, Prostaglandins and Skin Health (Overview)

Introduction

As one of their primary functions, the unsaturated fats consumed from the diet, and from supplements containing essential fatty acids (ALA, GLA, EPA), are taken up by the cells of the body and incorporated into the structure of the cell membrane (they esterify the phospholipids of the cell membrane). Upon activation by the phospholipase enzyme, these unsaturated fats are released from their phospholipid attachments and are subsequently converted into prostaglandin hormones.

Different unsaturated fats give rise to the formation of either prostaglandin series 1, 2, or 3. Prostaglandin series –1 and 3 (PG-1, PG-3) make the skin soft, smooth, silky and moist, whereas prostaglandin series-2 makes the skin more rough, dry and scaly, and has been shown to cause or aggravate a number of skin conditions such as eczema (atopic dermatitis), psoriasis and other conditions.

Prostaglandin Series 2 (PG-2)

PG-2 is formed from the unsaturated fat known as arachidonic acid, which is found in rich concentrations in high fat meats and high fat dairy products. As well, the over consumption of linoleic acid (an unsaturated fat found in corn oil, sunflower seed oil and safflower seed oil), encourages its conversion to arachidonic acid by the body, adding to the cell membrane concentrations of arachidonic acid. Higher cell membrane concentrations of arachidonic acid, from the over consumption of these foods, tends to favor the synthesis of PG-2, contributing to poor skin texture and appearance.

Unfortunately, the typical North American diet is a rich source of arachidonic acid and linoleic acid, and thus, most individuals produce too much PG-2 in their epidermal cells, which results in skin texture and appearance that is much less smooth and soft than is attainable, and contributes to a host of poor complexion problems and specific skin disorders.

Prostaglandin Series 1 (PG-1)

In contrast to the deleterious effects of PG-2 on the skin, prostaglandin series 1 (PG-1) and prostaglandin series 3 (PG-3) make the skin soft, smooth, silky and moist (1). The key building block for PG-1 is an unsaturated fat known as GLA (gamma-linolenic acid), which is found in high concentrations in borage oil (22% yield, whereas evening primrose oil is only

a 9% yield). GLA can also be formed in the body from linoleic acid, but individuals with certain conditions (diabetes, eczema) have been shown to have a defect in the enzyme that converts linoleic acid to GLA (delta-6 desaturase enzyme). As well, the consumption of alcohol, refined sugars and hydrogenated fats tends to inhibit the conversion of linoleic acid to GLA. The aging process itself also slows the conversion of linoleic acid to GLA as the delta-6 desturase enzyme becomes more sluggish. As such, most, if not all, individuals have sub-optimal cell membrane concentrations of GLA, and thus, GLA supplementation (e.g. borage oil) has been shown to improve skin texture and various skin conditions (eczema) in human studies via its conversion to PG-1 within epidermal cells. Also note that the commonly seen sub-optimal intake of Vitamin B6, zinc and magnesium slows the conversion of linoleic acid to GLA, as these nutrients act as co-enzymes in this biochemical reaction.

Prostaglandin Series 3 (PG-3)

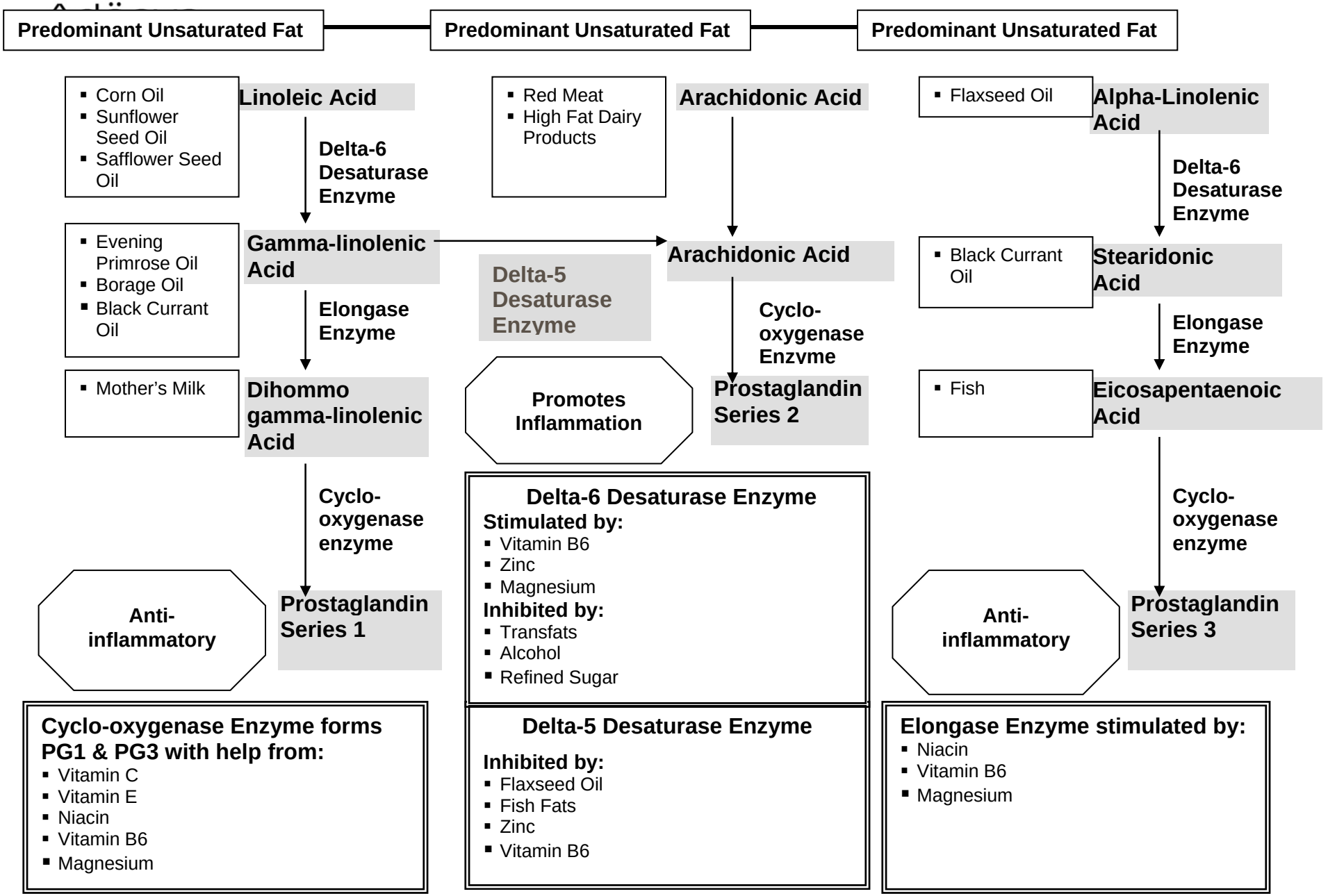
PG-3 also makes the skin very smooth, soft, silky and moist. PG-3 is formed from the omega-3 unsaturated fat known as EPA (eicosapentaenoic acid), which is found in cold-water marine fish such as salmon, mackerel and tuna, and supplements containing EPA. The body can also convert omega-3 unsaturated fat ALA (alpha-linolenic acid) into EPA, increasing the production of PG-3. ALA is found in rich concentrations in flaxseed oil (58% yield). Thus, supplementation with flaxseed oil and/or a high-yield fish oil have been shown to significantly increase production of PG-3, improving skin texture and appearance, and improving certain skin conditions (psoriasis and eczema). Fish oil also contains DHA (docosahexaenoic acid), which the body can convert into EPA and thus, PG-3, if required. DHA is also used to promote the development and function of the brain and is required for vision.

PG-3 is considered to be very important for total body wellness as it also reduces risk of heart attacks by dilating blood vessels and reducing abnormal blood clotting. PG-3 has been shown to reduce cancer risk by slowing down the cell division rates (more rapid cell division leads to increased genetic mutations and thus, increased formation of cancer cells, with less time for DNA repair enzymes to correct the mistakes). This has also been shown to be true with respect to skin cancer in experimental studies, whereby higher PG-2 levels in skin cells produced a significantly higher yield of cancer development upon exposure to ultra-violet light. PG-3 is also known to reduce inflammation (including skin inflammatory responses), a role if shares with PG-1. Thus, supplementation with borage oil, flaxseed oil and a high-yield fish oil (30% EPA/20% DHA) is not only beneficial to improve skin texture and appearance, and to treat certain skin

conditions, but it is also of value in the global prevention of heart and cardiovascular disease, cancer, and in the management of inflammatory conditions such as arthritis, Crohn's disease, colitis, diabetic neuropathies, skin inflammatory conditions, etc.
Note that the conversion of ALA to EPA requires optimal amounts of Vitamin B6, zinc, magnesium, and niacin (Vitamin B3), as coenzymes. As well, the synthesis of PG-1 and PG-3 also requires optimal amounts of Vitamin C, Vitamin E, and selenium. These antioxidants affect the enzyme cyclooxygenase, which is the final enzyme in the conversion of essential fats to PG-1 and PG-3.

The omega-3 fats (ALA, EPA and DHA) also inhibit the conversion of GLA to arachidonic acid by inhibiting the delta-5 desaturase enzyme. Thus, ALA, EPA and DHA not only increase the synthesis of PG-3, but they help to inhibit the cell membrane build up of arachidonic acid, and thus, PG-2 synthesis.

PROSTAGLANDIN FORMATION



The following chart illustrates the relative percentage of polyunsaturated fat (mostly linoleic acid) monounsaturated fat (oleic acid) and saturated fat in common oils. I recommend the use of olive oil, canola oil and peanut oil in moderate amounts as a substitute for oils containing more polyunsaturated and saturated fats.

FATTY ACID CONTENT OF COMMON VEGETABLE OILS			
VEGETABLE OIL	**POLYUNSATURATED (%)**	**MONOUNSATURATED (%)**	**SATURATED (%)**
Safflower	74	12	9
Walnut	66	15	11
Sunflower	64	21	10
Wheat Germ	61	16	17
Corn	58	25	13
Soybean (unhydrogenated)	58	23	15
Cottonseed	51	19	26
Sesame Seed	40	40	15
Soybean (partially hydrogenated)	40	47	13
Peanut	30	46	19
Olive	9	72	14
Palm	9	38	48
Coconut	2	6	86
Canola	30	54	7

Review the chart below which illustrates the amount of Omega-3 Fats in various fish and seafood. Consider choosing fish and seafood high in Omega-3 Fats two to three times per week on an on-going basis.

WHERE TO GET OMEGA-3 OILS	
OMEGA-3 OIL CONTENT IN A 4-OUNCE SERVING	**SPECIES**
3.6 grams	Chinook Salmon
2.3 grams	Sockeye Salmon
2.6 grams	Albacore Tuna
1.8 - 2.6 grams	Mackerel
1.2 - 2.7 grams	Herring
1.0 grams	Rainbow Trout
0.9 grams	Whiting
0.6 grams	King Crab
0.5 grams	Shrimp
0.3 grams	Cod

The **highest fat fish,** with more than 5% body fat, include salmon, mackerel, herring, anchovies, sardines, shad albacore tuna and trout.

Medium fat fish, with fat levels that hover between 2.5% and 5% include bluefin tuna, rockfish, halibut, mullet, red snapper and swordfish.

MEDICINAL OILS (To Consider as Supplements)		
OIL PRODUCT	**ALPHA-LINOLENIC ACID %**	**GAMMA-LINOLENIC ACID %**
Flaxseed Oil	58	0
Borage Oil	0	22
Black Currant Oil	13	22
Pumpkin Seed Oil	15	0
Evening Primrose Oil	0	9
Canola Oil	7	0
Soy Oil	9	0

Summary of Dietary & Supplementation Measures to Improve Skin Smoothness & Texture

1. Choose only low fat animal products in place of high fat meats and dairy products:

MEATY FOODS	DAIRY FOODS
Chicken Breast	Non-fat or 1% milk or yogurt
Turkey Breast	Cheese – less than 3% milk fat
Cornish hen	
Most Fish (Omega-3 fats)	
Egg Whites	
Soy Products	

2. Use olive oil, canola oil or peanut oil for salad dressings, stir-fry or to sauté vegetables.
3. Avoid the use of corn oil, sunflower seed oil, safflower seed oil, or mixed vegetables as much as possible.
4. Minimize intake of alcohol, refined sugars, and hydrogenated and trans-fatty acids, such as margarine, shortenings, peanut butter, etc.
5. Supplement with 2,000 to 4,000 mg of a mixture of flaxseed, borage oil and high-yield fish oil (EPA, DHA).
6. Take a high potency Multi Vitamin and Mineral that contains the following antioxidants, B-complex and mineral support:

Vitamin E (natural source)	400 I.U.
Vitamin C	1000 mg
Beta-carotene	10000 I.U.
Vitamin A	2500 I.U.
B-50 Complex	50 mg of most B-vitamins
Selenium	100 to 200 mcg
Zinc	15 mg
Magnesium	200 mg

Adëeva *Nature's Essential Oils*: Scientific Research Support

Prostaglandins & Essential Fatty Acids

- Prostaglandins are local hormones that are produced by almost every cell in the body (except erythrocytes-RBCs)
- Prostaglandins exert their hormone-like effects at the site of their production or next to the cells that secrete them
- Prostaglandins are known to be involved in the inflammatory process of the skin and determine the roughness, scaliness, and dryness of the skin to significant degree
- Optimal synthesis and balance of epidermal prostaglandins help produce skin that is smooth and moist
  - o *Pustisek, N, Lipozencic, J. Prostaglandins in dermatology.vActa dermatovenerologica Croatica: ADC (Acta Dermatovenerol Croat) 2001 Dec; 9(4), pp.291-8*

Essential Fatty Acids and Skin Cell Prostaglandin Synthesis

- Essential fatty acids are incorporated into the phospholipid structure of skin cell membranes, which regulate the fluidity of the cell membrane and provide the precursors for prostaglandin synthesis; some of which promote inflammation and hyperproliferation of skin cells (PG-2) while others promote a smooth and healthy appearance of the skin (PG-1 and PG-3)
  - o *Pustisek, N, Lipozencic, J. Prostaglandins in dermatology.vActa dermatovenerologica Croatica: ADC (Acta Dermatovenerol Croat) 2001 Dec; 9(4), pp.291-8*

Linoleic Acid And Skin Texture

- Linoleic acid makes up approx. 15-25% of the fatty acids in the stratum corneum
- Deficiencies in linoleic acid cause defects in the skin's barrier function, which lead to increased transepidermal water loss, epidermal hyperproliferation, and decrease in prostaglandin series-1 (PG-1)
- Clinically, this appears as erythematous, dry, weepy, and scaling lesions of the skin
- Studies by Horrobin D indicate that supplementation with evening primrose oil (containing linoleic and gamma linolenic acid) can reverse these problems and improves clinical outcomes in atopic eczema, especially pruritis
  - o *Reichert, R. Evening Primrose Oil Cream, Dry Skin, & Atopic Disposition. Quarterly Review of Natural Medicine, Spring'98, p.7*

Essential Fatty Acids and Skin Cell Prostaglandin Synthesis

- In the skin epidermis, the metabolism of polyunsaturated fatty acids (PUFAs) to prostaglandins is highly active
- Studies show that dietary oils influence the distribution of PUFAs in epidermal phospholipids and the epidermal levels PUFA-derived hydroxy fatty acids.
- As such, the feeding of EPA and DHA-rich fish oils results in higher epidermal phospholipid levels of 15-hydroxy EPA and 17- hydroxy DHA, which produce anti-inflammatory and antiproliferative effects, improving skin texture.
- The feeding of borage oil (rich in GLA) results in higher epidermal levels of the epidermal elongase product of GLA, known as dihomogammalinolenic acid (DGLA), which is converted to the anti-inflammatory and antiproliferative hydroxy fatty acid and prostaglandin hormone known as 15-hydroxyeicosatrienoic acid and PG-1, respectively.
- Thus the 15-lipoxygenase enzyme plays an important role in converting dietary PUFAs into either pro-inflammatory and hyperproliferative eicosanoids or anti-inflammatory and anti-proliferaive eicosanoids, within epidermal cells.
- These biochemical pathways have been shown to be of importance in the ability of medicinal oils to effectively treat chronic inflammatory skin conditions and improve the smoothness and texture of the skin

- *Ziboh, V.A., Miller, C.C., Cho, Y. Metabolism of polyunsaturated fatty acids by skin epidermal enzymes: generation of antiinflammatory and antiproliferative metabolites. Am J Clin Nutr 2000 Jan; 71 (1 Suippl), pp.361S-6S*
- *Miller, C.C., Tang, W, Ziboh, V.A., Fletcher, M.P. Dietary supplementation with ehtyl ester concentrates of fish oil (n-3) and borage oil (n-6) polyunsaturated fatty acids induces epidermal generation of local putative anti-inflammatory metabolites. J Invest Dermatol, 1991, Jan; 86 (1), pp.96-103*
- *Miller, C.C., Ziboh, V.A. Gammalinolenic acid-enriched diet alters cutaneous eicosanoids. Biochem Biophys Res Commun, 1988 Aug 15; 154 (3), pp. 967-74*

The Damaging Effects of Arachidonic Acid on Skin Cells

- A major proinflammatory metabolite of arachidonic acid, leukotriene B4 accumulates in Psoriasis, as epidermal 15-lipoxygenase metabolizes arachidonic acid into 15-hydroxyeicostetraenoic
- EPA and GLA are both metabolized by epidermal 15-lipoxygenase into 15-EPA & 15-hydroxyeicosatriaenoic acid, respectively
- Both 15-EPA & 15- hydroxyeicosatriaenoic acid are potent in vitro inhibitors of leukotriene B4 generation

- Thus, some authorities recommend supplementation with EPA, ALA and/or GLA –containing oils as a means to suppress cutaneous inflammatory disorders and improve skin appearance and smoothness
- Animal studies reveal that EPA supplementation, but not DHA supplementation, produces anti-inflammatory effects on UVA and UVB-induced acute inflammatory reactions of the skin
  - *Ziboh, V.A. Implications of dietary oils and polyunsaturated fatty acids in the management of cutaneous disorders. Arch Dermatoil 1969 Feb; 125 (2), pp. 241-5EPA And Skin Health*
  - *Danno, K., Ikai, K., Imamura, S. Anti-inflammatory effects of eicosapentaenoic acid on experimental skin inflammation models. Arch Dermtol Res 1993; 285 (7), pp. 432-5*

Psoriasis and Eczema

Treatment With Medicinal Oils

- A clinical trial involving 13 patients with psoriasis demonstrated that 8 of the 13 patients receiving EPA and DHA supplementation showed mild to moderate improvement of their global psoriasis symptoms after 8 weeks, which correlated with higher epidermal phospholipid levels of EPA and DHA than baseline levels recorded prior to supplementation with these omega-3 fats
- In atopic eczema evidence suggests that there is a defect in the conversion of linoleic acid to GLA (due to defective delta-6-desaturase enzyme), which results in skin roughness, and elevated catecholamine concentrations in patients with atopic eczema.
- Supplementation with oils containing GLA have resulted in improvement of atopic eczema in double-blind, placebo controlled crossover trials.
- Carriers of cystic fibrosis tend to be atopic as well, supporting the notion that part of the defect in these patients lies in a faulty delta-6-desaturase enzyme function
- Other studies indicate that as we age the delta-6-desaturase enzyme activity declines, permitting more rapid cellular aging of skin cells
- Thus, patients with eczema, psoriasis, rough, dry and/or scaly skin (and as a means to potentially slow or reverse skin aging) should consider the use of GLA-containing medicinal oils and omega-3 fat supplementation as a means to alter the epidermal phospholipid PUFA profile and eicosanoid concentrations in such a way as to result in significant improvement to skin texture, hydration and overall appearance
  - *Horrobin, D.F. Essential fatty acid metabolism and its modification in atopic eczema. Am J Clin Nutr, 2000 Jan; 71*

(1 Suppl), pp.367S-72S

- *Manku, M.S. Horrobin, D.F., Morse, N., Kyte, V, Jenkins, K, Wright, S., Burton, J.L. Prostaglandins Leukot Med, 1982 Dec; 9 (6), pp.615-28*
- *Raederstorff, D., Loechleiter, V., Moser, U. Polyunsaturated fatty acid metabolism of human skin fibroblasts during cellular aging. Int J Vitam nutr Res 1995; 65 (1), pp. 51-5*
- *Ziboh, V.A., Cohen, K.A., Ellis, C.N., Miller, C., Hamilton, T.A., Kragballe, K., Hydrick, C.R., Voornees, J.J. Effects of dietary supplmentation of fish oil on neutrophll and epidermal fatty acids. Modulation of clinical course of psoriatic subjects. Arch Dermatol, 1986 Nov; 122 (11), pp.1277-82*

ALA and Skin Health

- Studies using ALA-containing oils (e.g., flaxseed oil) have also shown that it can reduce synthesis and concentrations of arachidonic acid and PG-2 in the cell membrane (RBC) of animals afflicted with atopic eczema (dermatitis) and improve blood flow to the skin (due to the vasodilation effect of PG-3 and other EPA derivatives, such as hydroxy fatty acids)

- *Suzuki, R., Shimizu, T., Kudo, T., Ohtsuka, y., Yamashiro, y, Oshida, K. Effects of n=3 polyunsaturated fatty acids on dermatitis in NC/Nga mice. Prostaglandins Leukot Essent Fatty Acids, 2002 Apr; 66 (4), pp. 435-40*

Prostaglandin Series-2 & The Promotion Of Skin Cancer

- Animal studies suggest that PG-2 production in skin cells may promote the development of skin cancer, likely due to its hyperproliferative properties
- This evidence is further supported by the studies demonstrating that oral ingestion of various non steroidal anti-inflammatory drugs, such as indomethacin, piroxicam or celecobix (which block the cyclo-oxygenase enzyme, preventing the synthesis of PG-2), prevented the development of UV-induced skin cancers by up to 85%
- In fact, the drug celecobix had therapeutic efficacy in that it caused regression of preexisting skin cell tumors

- *Fishcher, S.M. Is cyclooxygenase-2 important in skin carcinogenesis? J Environ Pathol Toxicol Oncol, 2002; 21 (2), pp. 183-91*

Adëeva *Nature's Essential Oils* Ingredients

This supplement contains the optimal blend of GLA, ALA, EPA and DHA essential oils to enable skin cells to produce PG-1 and PG-3, and help suppress the formation of PG-2. The result is smoother, softer, moister skin, with improved complexion, and varying degrees of improvement with eczema, psoriasis, acne and other skin conditions.

This supplement contains omega-3, omega-6 and omega-9 essential fatty acids derived from:

- Borage seed oil – GMO free (a rich source of GLA – an omega-6 fat)
- Flaxseed oil – GMO free (a rich source of ALA- an omega 3 fat)
- Fish oil – GMO free (a rich source of EPA-30% and DHA-20% -omega-3 fats) (from mackerel, sardines, anchovies)Note that flaxseed oil and borage seed oil also contain some oleic acid, which is the health-promoting monounsaturated fat (omega-9 fat) that occurs in high concentrations in olive oil (72% yield) and canola oil (54% yield), (soy bean oil is a 47% yield and peanut oil is 46% yield of oleic acid).

Nature's Essential Oils **Ingredients**

- Each capsule contains (1200 mg capsule). 90 capsules per bottle (1 month supply)
- Borage seed oil (GMO free) – 400 mg
- Flaxseed oil (GMO free) – 400 mg
- Fish oil (GMO free) – 400 mg (high yield EPA-30%, DHA 20% oil, derived from mackerel, sardines and anchovies)

Take two capsules with one meal and one capsule with any other meal, for a total of 3,600 mg of total essential oil supplementation per day.

Please note: The use of *Nature's Essential Oils* replaces the need for the client or patient to take any other essential fatty acid supplement (e.g., flaxseed oil, black currant oil, borage seed oil, fish oil, any other combination of essential fatty acids). Patients who have had a kidney or liver transplant should check with their attending physician prior to using this any supplement product, including *Formula 2*.

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