

How TunaCaps Work

Arthritis is a common chronic systemic inflammatory disease that results in progressive disability. Early disease is characterised primarily by inflammation of the synovium (the inner membrane of the capsule of the synovial joints) as the disease progresses the patient suffers destruction of cartilage and bone. Since there is no cure, management is aimed at relieving pain and improving or maintaining joint function.

Fish oils containing n-3 fatty acids (omega 3 fatty acids) have been reported to decrease pain and stiffness in arthritis. The n-3 fatty acids found in fish oil namely Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) have the ability to suppress the production of inflammatory eicosanoids and cytokines; and suppress the production of cartilage degradative enzymes.

There are four types of Eicosanoids produced within the body from polyunsaturated fatty acids; these are Prostaglandins, Thromboxanes, leukotrienes and lipoxins. There are many sub types of each of these four different classes and each of these can have a different function within the body, thus the balance of eicosanoids has an effect on chronic diseases. There are three primary pathways that the polyunsaturated fatty acid when released from the cell membrane can follow, these are:

- 1.) COX producing Prostaglandins and Thromboxanes
- 2.) 5-LOX producing Leukotrienes
- 3.) 12/15-LOX producing Lipoxins

The COX pathway is the one which is blocked by non-steroidal anti inflammatory drugs eg Ibuprofen. This occurs by inhibiting the cyclo-oxygenase enzyme (COX). This works well as some of the prostaglandins produced (eg PGE₂) produce pain. However the cell will eventually produce more of the cyclo-oxygenase enzyme and so the pain can return. However these drugs also inhibit the production of other prostaglandins which have a protective effect on the stomach and consequently the non-steroidal anti-inflammatory drugs have the side effects of causing gastro-intestinal disturbances.

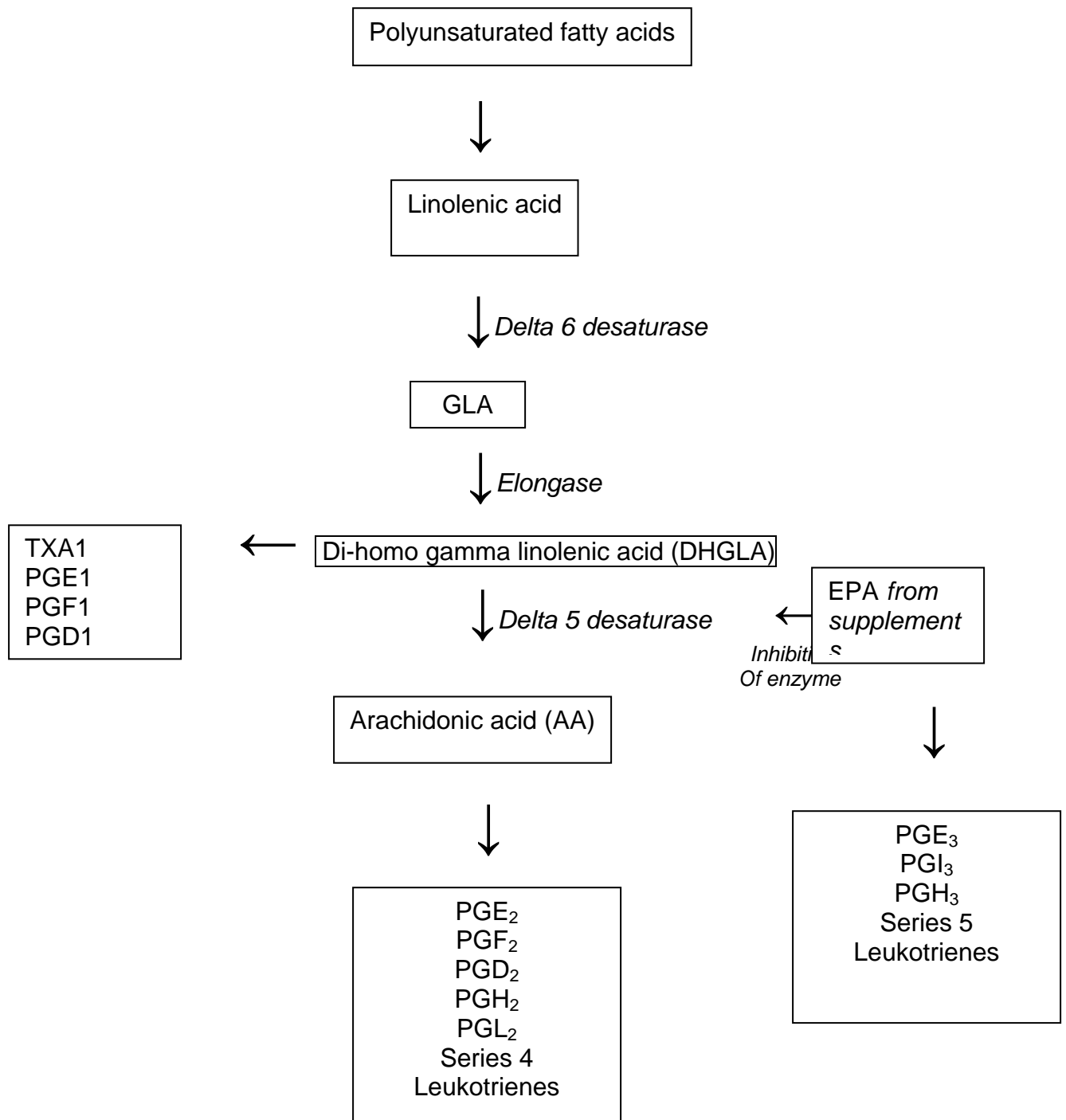
The leukotrienes produced by the 5-LOX pathway are mediators of pain eg LTB₄, Corticosteroids affect the production of these molecules.

These inflammatory eicosanoids can also promote the release of pro-inflammatory cytokines

Both of these pathways need a starting material known as Arachidonic acid, which is produced from the original fatty acid released from the cell membrane. However if the level of EPA is high enough in the body then this is replaced as the starting material. If Leukotrienes, Prostaglandins or Thromboxanes are produced from EPA then they either have a very weak inflammatory action or they are neutral.

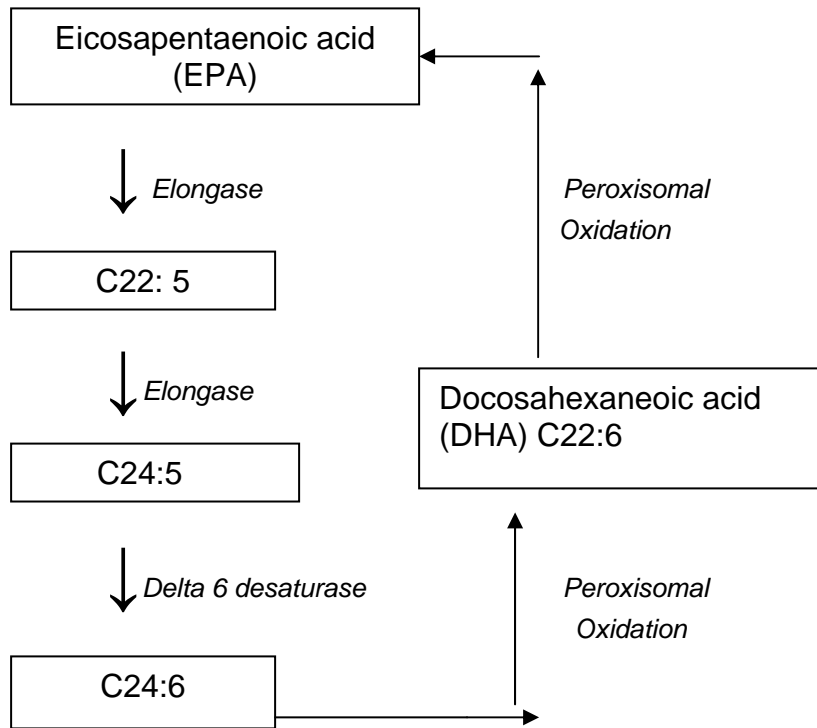
EPA also has an additional benefit in that it can interfere with the enzyme delta-5-desaturase which produces arachidonic acid from Dihomo-gammalinolenic acid (DGLA). If Arachidonic acid production is halted then the DGLA which is left can also be used to produce eicosanoids one of which is PGA₁ which can inhibit the production of cytokines. The following pathway represents the way in which the eicosanoids are produced

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The tuna caps contain 6% EPA and 25% DHA with 1% of vitamin E and are available in 500mg and 1000mg strength. The recommended daily dose is 2000mg per day. The quantity of Omega 3 fatty acids within the tuna cap is high and although the capsules contain a higher % of DHA this can easily be converted into EPA if required, as shown in the following diagram.

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Most other capsules on the market contain Cod liver oil, however these also contain vitamin A as they are extracted from the fish livers. It is well documented that vitamin A can cause toxicity problems. Consequently the consumer may take in excessive quantities of vitamin A which may cause potential health issues. The tuna oil is extracted from the body of the fish and consequently the level of vitamin A in the tuna oil is negligible.

Thus, the n-3 fatty acids namely EPA and DHA found in fish oil reduce the pain and inflammation associated with arthritis by altering metabolic pathways thereby reducing the production of messengers (eicosanoids) which create the pain and inflammation. In doing this, the pathway is changed so that the messengers produced are much less inflammatory or are neutral. However, this is only one aspect to arthritis, the other which is destruction of cartilage, is discussed below with the way in which n-3 fatty acids help to improve the condition.

Cartilage Chondrocytes are responsible for the synthesis and maintenance of a specialised matrix composed predominantly of type II collagen enmeshing aggregates of cartilage proteoglycan (aggrecan) bound to Hyaluronan and stabilised by cartilage link protein.

The entrapment of the proteoglycan (aggrecan) within the collagen provides cartilage with its load bearing capacity. It is the role of the chondrocytes which must balance the synthesis and degradative processes in order to maintain cartilage integrity.

During degenerative joint disease the Chondrocytes elicit catabolic responses by increasing production of proteolytic enzymes eg aggrecanase and collagenase which exceed the production of new matrix molecules.

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The n-3 fatty acids found in fish oil can alter the factors that cause degeneration and inflammation in cartilage destruction. The incorporation of n-3 fatty acids into cartilage chondrocytes membranes results in a dose dependant reduction of the expression of aggrecanases and expression of inflammatory cytokines.

This shows that supplementation with n-3 fatty acids can specifically alter the mechanisms involved in chondrocyte production which can alter the regulation of anabolism or catabolism of cartilage.

In conclusion the n-3 fatty acids (Omega 3 fatty acids) EPA and DHA have a dual mode of action potentially slowing cartilage degradation and the reducing pain and inflammation associated with arthritis.