

Short Communication

Unbalanced omega ratio and omega 3 deficiencies in world makes our immune system less effective to fight with virus and other infections

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Received: 10 April 2020

Accepted: 06 May 2020

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ABSTRACT

According to the report of a global survey of the omega-3 fatty acids. majorities of countries in the world are facing the deficiency of essential fatty acids specially of omega 3, this very low level of essential fatty acid leads to increase global risk for chronic disease. Many reports are published about the role of omega 3 on the immune system in health and in diseases, especially those caused by the excessive inflammatory response. Numerous studies have shown that these compounds are immunoregulatory and immunosuppressive and thus may increase susceptibility to infection. They also manipulate the functions of antigen-presenting cells and lymphocytes, including T and B cells, NK cells, LAK cells and also T regulatory cells. In this article, we made a simple attempt to elucidate the effect of omega-3 deficiency in our immune system, especially during the virus and other infections. In this period of severe virus infections studies on omega3 and its role in immune is of great Interest.

Keywords: Covid 19, Essential fatty acids, Immunity, Infectious diseases, Omega 3, Virus

INTRODUCTION

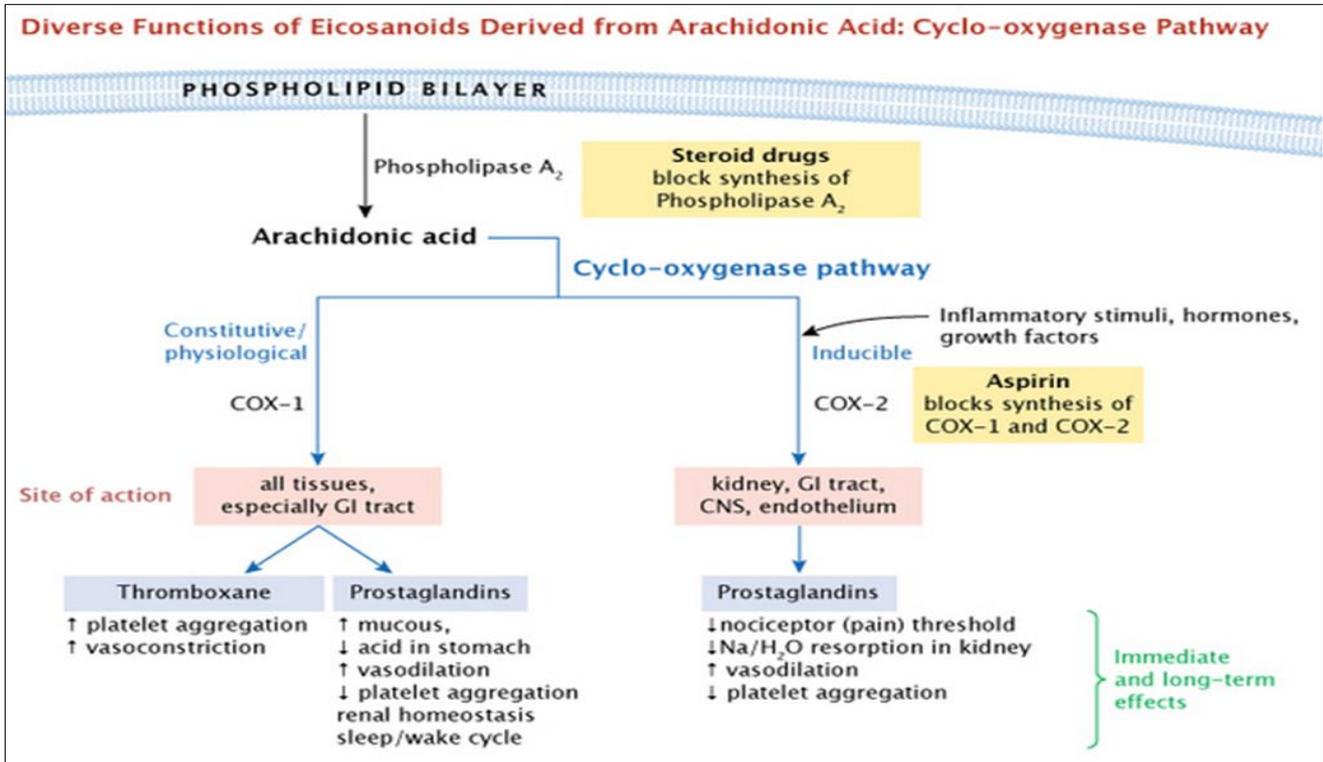
Essential fatty acids support the body's natural anti-inflammatory response because they are converted into anti-inflammatory molecules. Many studies and scientific evidence indicate that they help to naturally regulate the immune response and support the internal repair systems that operate in response to inflammation. The amount and ratio of omega-3 to omega-6 essential fatty acids that a person consumes directly impacts the health of their immune and inflammatory response. The ratio of fatty acids within their cell membranes directly influences whether the immune response synthesizes proinflammatory or anti-inflammatory molecules. When the immune system is triggered for example by injury, allergy, or infection fatty acids are released from the cell membranes. These fatty acids are converted into molecules as part of the body's natural healing response.¹

In 1929 Burr and Burr examined the effect of fat free diet on rat, he was found that after a month rats on a fat free

diet, failed to thrive and developed severe kidney and skin related problems and often died within a week and discovered that just by adding two essential fatty acid, linolenic and linoleic acids, restored the sick animals to health, while the other fatty acids were unable to do so.² This led to the recognitions of linolenic and linoleic acids as essential fatty acids. Linolenic and linoleic fatty acids contain long carbon chains of 18 carbons each, but other fatty acids of similar size, such as steric acid and oleic acid, cannot replace them. These "essential" fatty acids are polyunsaturated meaning they contain multiple carbon-carbon double bonds. Scientists have determined that the key structural feature that makes these molecules different is the position of their double bonds. Our body has enzymes that can change the structure of fatty acids as needed. The enzymes in our body can only able to insert double bonds within 10 carbons of the carboxylic acid end of fatty acids, so we cannot produce the carbon-carbon double bond at the omega-3 position of linolenic acid, or the double bond at the omega-6 position of linoleic acid. It is the presence of these very crucial and

specific double bonds that allows these fatty acids play important roles in our bodies. Later the Swedish scientist found that these essential fatty acids were the precursor of signaling molecules prostaglandins. Researchers found various functions of prostaglandins these molecules aid pain and inflammation, regulated

pregnancy and child-birth, controlled blood pressure and the secretion of stomach mucus and acid, contracted or relaxed smooth muscle. Most interestingly, they found some pairs of prostaglandins had actions that opposed each other.³



Source: Neitzel JJ. Fatty acid molecules: fundamentals and role in signaling. Nature Educat. 2010;3(9):57. The COX-1 and COX-2 enzymes activate a wide variety of effects in multiple tissues. COX-1 activates both thromboxane and prostaglandins, while COX-2 activates prostaglandins only.

Figure 1: Essential fatty acid pathways.

This essential fatty acid synthesis very important signalling molecules called eicosanoids, Thromboxane's, leukotrienes, synthesized using arachidonic acid as a precursor. Thromboxane, produced in platelets, constricts blood vessels and promotes platelet aggregation, an early step in blood clotting. Leukotrienes attract immune cells (such as neutrophils) to sites of inflammation, constrict bronchioles in the lungs, and make capillary walls permeable.⁴ Some medical treatments interfere with these actions, as a way to improve health. As a common example, inhalers that are widely used for asthma treatment deliver the drug montelukast, which blocks the interaction between leukotriene molecules and their receptors to inhibit this process.

These molecules bind to cell-surface proteins of the seven-helix-G protein-coupled receptors (GPCRs). These in turn activate either the cyclic AMP pathway or the inositol phosphate-calcium pathway. Altogether, these cascading pathways can produce both immediate and long-term changes in their target cells.⁵

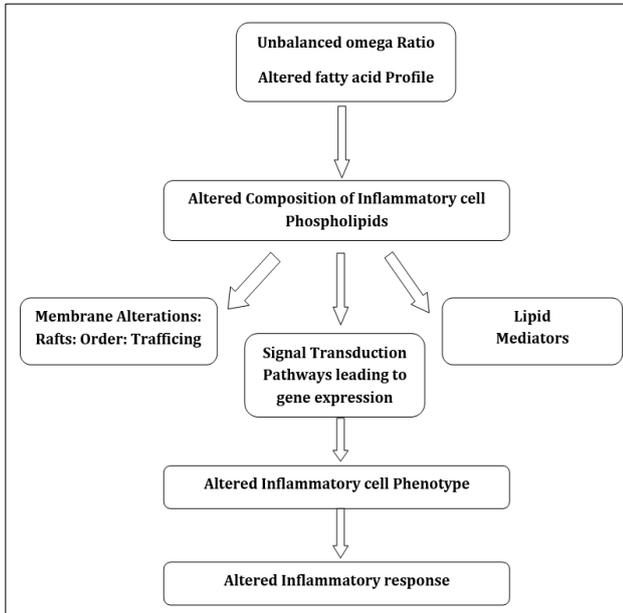
“Inadequate supply of these essential fatty acids and omega 3 and omega 6 ratio affect the signaling efficiency of these signaling molecules”.

Fatty acid composition of inflammatory cell affects membrane fluidity, membrane raft formation, the signal transduction process leading to gene expression, and the pattern of lipid and peptide mediators produced. Fatty acid can affect inflammatory cell response and inflammatory processes.

What about COVID 19?

Human pathogenic corona viruses [severe acute respiratory syndrome corona virus (SARS-CoV) and SARS-CoV-2] bind to their target cells through angiotensin-converting enzyme 2 (ACE2), which is expressed by epithelial cells of the lung, intestine, kidney, and blood vessels.⁶ PUFAs for common metabolic enzymes and thereby decreasing the production of vasoconstrictor rather than vasodilator and anti-inflammatory eicosanoids. PUFAs also reduce

angiotensin-converting enzyme (ACE) activity, angiotensin II formation, tumor growth factor-beta (TGF-beta) expression, enhance endothelial nitric oxide (NO) generation and activate the parasympathetic nervous system.⁷ Deficiency or pharmacological inhibition of prostaglandin and leukotriene production often results in a dampened inflammatory response to acute infection with a respiratory virus.



Source; Calder PC. The effect of dietary fatty acids on the immune response and susceptibility to infection. In R. M. Suskind, and K. Tontisirin (Eds.), Nutrition Immunity and Infection in Infants and Children; 2000:137-172. (Nestlé Nutrition Workshop Series, Paediatric Program; Vol. 45. Philadelphia, US: Lippincott Williams and Wilkins).

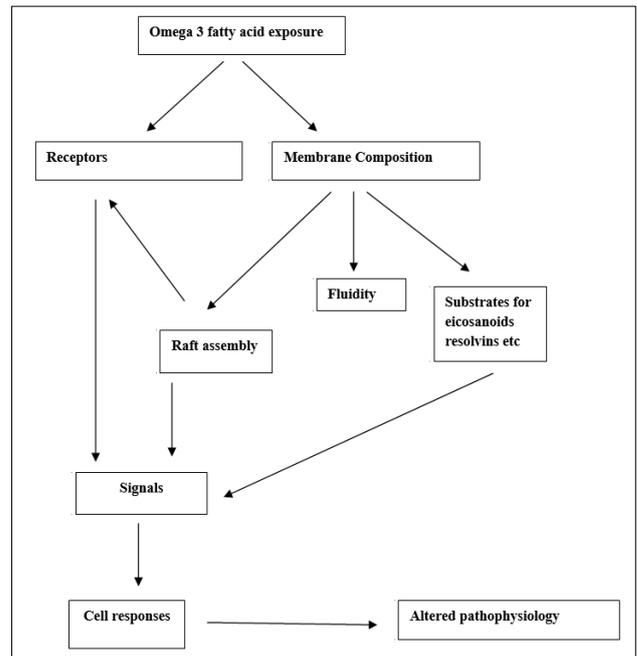
Figure 2: Theory of altered inflammation.

Omega 3/omega 6 imbalanced altered the fatty acid profile which a later the composition of inflammatory cell phospholipid which directly affect the signaling process pathway leads to altered inflammatory response.

CONCLUSION

There is a dramatic increase in the omega 6 consumption in our diet for the last 50 years (meat and omega 6 rich vegetable oils). The amount and ratios of these fats in our diet could increase or decrease the synthesis of prostaglandins, thromboxane's, and leukotrienes in our bodies. They could also increase or decrease the effects of these signals to their normal target cells. Similar signaling molecules derived from fatty acids are found in diverse organisms. In the last 20 years, our diet and lifestyle influences these pathways, whether by intake of large amount of processed and trans fats and the unbalanced ratio of omega-6 to omega-3 fatty acids, leads to either blocked the pathways by acting as steroids and increase the inflammation in body or unavailability of essential fatty acids and the unbalanced omega ratio

weaken the efficiency of synthesis these signaling molecules.



Source: Calder PC. Omega-3 polyunsaturated fatty acids and inflammatory processes: nutrition or pharmacology? Br J Clin Pharmacol. 2013;75(3):645-62.

Figure 3: Role of omega 3 in alteration of cell physiology.

PUFAs can be incorporated into the phospholipids of inflammatory cell membranes play important roles assuring the correct environment for membrane protein function, maintaining membrane order ("fluidity") and influencing lipid raft formation. Membrane phospholipids are substrates for the release of (non-Esterified) PUFAs intracellularly - the released PUFAs can act as signaling molecules, ligands (or precursors of ligands) for transcription factors, or precursors for biosynthesis of lipid mediators which are involved in regulation of many cell and tissue responses, including aspects of inflammation and immunity

Significance statement

Finding suggested that unbalanced omega 6/omega 3 ratio and omega 3 deficiency increases the burden of high inflammation and alter the immune system response of body, balanced omega 6 and omega 3 supplementation can improve and impair host resistance to a number of pathogens. However, the data are limited but currently the subject of great research interest because of its possible impact on all aspects of human health and immunity. Authors believe that direct examination of unbalanced omega 6/omega 3 ratio on human infectious disease resistance is warranted. Omega 3 deficiency is required attention; The time has come to understand the importance of these essential fatty acids.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Bhardwaj K, Verma N. Unbalanced omega ratio and omega 3 deficiencies in world makes our immune system less effective to fight with virus and other infections. *Int J Res Med Sci* 2020;8:2339-42.