
Preface

This book, “*Omega-3 Fatty acids: Keys to Nutritional Health*,” is the product of our sincere effort, to provide scientific evidence for the extraordinary power of nature’s wonder molecules—omega-3-fatty acids. Chapters by experts in different specific aspects of omega-3 fatty acids for human health, have been presented to our wide spread readers, nutritionists, dieticians, clinicians, and all health conscious readers and health professionals. There is no exaggeration if we state that man owes his very existence on this planet to omega-3 fatty acids, as these molecules are largely responsible for the creation human brain. It is the brain that gives man the extraordinary power to sense the nature and its environment and enable him to adapt, to live in more comfort. Omega-3 fatty acids, besides being the hardware of the brain, take active part in almost every aspect of life reactions in health and disease.

Our Chap. 1 on “*Nutrition, Life, Disease, and Death*” narrates the importance of supply of all essential nutrients in adequate quantities including omega-3 fatty acids and Chap. 36 of Dr. M. Jeganathan on “*Role of Antioxidants*” which are also needed not only as anti-stress, anti-aging nutrient, but also to prevent oxidation of omega-3 fatty acids in human body’s hostile environment.

It is unequivocally established that recent rise in the incidences and severity of several diseases, including diabetes, heart disease, obesity, pregnancy complications, alzheimer, psoriasis and aging, can be primarily attributed to the paucity of omega-3 fatty acids in modern human diet. Hence, “*Bring Back Omega-3 Fatty acid into Food Chain*” has been aglobal cry. Therefore, our Chap. 2 on “*Flax Biovillage*” and Chap. 3, “*Linseed Agriculture*” by Dr. P.K Singh aim at unleashing the power of linseed, for omega-3 nutritional security. Chap. 21 by Dr. Scott Doughman presents a case of “*Microalgae oil*” and Dr. Rafael Zarate’s in Chap. 9, that of “*marine algae*,”as safe and effective vegetarian food. Authors argue that different biotechnological approaches can boost fatty acid yield in microalgae, and thereby, microalgae may become important attractive, continuous, sustainable good omega-3 source, to satisfy the increasing world demand. In Chap. 34, Georgia Lenihan-Geels discusses the prospects of bioengineering of plant seed oils for docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), algae aquaculture and enhancement of LC-PUFA in meat, and dairy products through plant-derived livestock feeds. In addition to increase the world omega-3 supply, for actually attaining omega-3 nutritional security and better health for one and all, another attractive complementary strategy is to fortify food, resourcing omega-3 fatty acid from flaxseed, marine algae, or fish oil sources. Manohar Panse in Chap. 8, while discussing the “*Omega-3 fatty acid Food Fortification*,” also highlights the importance of compliance of regulatory guidelines, required for marketing such products. Further, Manohar Panse has also discussed *Development of omega-3 eggs* in Chap. 5 and *World Market of Omega 3 Fatty Acids* in Chap. 7. Most importantly, the *pharmacokinetics of safety of omega-3 fatty acids* has been reviewed by Dr. Juan Tamargo in Chap. 39. Dr. Puranik in Chap. 10 describes *omega-3 oil emulsion* that prevents lipid peroxidation and also offers not only increased stability and shelf life but also better bioavailability. In our Chap. 4 on “*Omega-3 Milk*,” with our colleague Dr. P.B. Ghorpade and Dr. S.L. Bodhankar, we narrate the importance of incorporating omega-3 fatty acid in milk and its utility for human health.

The major problem today is the severe imbalance of the two essential fatty acids namely omega-3 and omega-6 fatty acids. Omega-3 fatty acids being primarily anti-inflammatory and omega-6 being proinflammatory, too much omega-6 and very little of omega-3 fatty acids in modern human diet, the disease-prone inflammatory pathway is dominant in the modern man. Dr. Kadooin in Chap. 15 discusses how omega-3 to omega-6 ratios can be manipulated in oilseeds to achieve balance of omega-3 and omega-6 fatty acids.

Most interesting thought-provoking chapters (Chaps. 27–32) have been provided by Robert Brown. His concern about the linoleic acid/alpha-linolenic acid imbalance and its influence on various aspects of ill health today is evident from the inferences drawn by him.

One of the major well-acknowledged effects of omega-3 fatty acids are their ability to prevent heart diseases. Dr. Manohar Garg in Chap. 6 discusses how omega-3 fatty acids control *hyperlipidemia*; Dr. Jubbin Jacob in Chap. 37, *cardiovascular disorder*; Dr. Quian Gao in Chap. 25, *cardiovascular events*; and Dr. Sang Lee in Chap. 33, *Myocardial Infarction*.

Dr. Sayed Ahmed in Chap. 11, discusses the mechanism by which EPA- and DHA-derived eicosanoids and lipid mediators contain chronic inflammation and prevent degenerative diseases.

Effects of omega-3 fatty acids on immune system in reducing the pathological manifestation especially in diseases related to inflammation, allergy, and autoimmunity have been discussed by Dr. Sudha Gangal in Chap. 26.

Dr. Vikas Kumar in Chap. 38 on *Psoriasis*, a multifaceted autoimmune disorder discusses the potential benefits of omega-3 fatty acid, their metabolites, and the mechanisms involved in psoriasis treatment.

Role of omega-3 fatty acids in mitochondrial diseases and its profound effects on muscle, brain, heart, liver, nerves, eyes, ears, kidney functions, involvement in CVD, and diabetes have been discussed by Dr. S. Katyare in Chap. 17. Dr. Katyare in chapter on diabetes shows the link between omega-3 fatty acids in diabetic complications, neuropathy, retinopathy, nephropathy, and angiopathy, and the beneficial effect of omega-3 fatty acid supplementation in Chap. 16, and Dr. Katyare further in Chap. 18 on Alzheimer argues that omega-3 fatty acid supplementation may be safe and prophylactic for Alzheimer's disease.

Oxidative stress and inflammation are the major mechanism that contributes to the pathogenesis of degenerative diseases including neurotraumatic, neurodegenerative, and neuropsychiatric diseases. Dr. Akhlaq A. Farooqui, in Chap. 19, concludes that increased consumption of omega-3 fatty acids may result in retardation of oxidative stress and neuroinflammation due to the production of resolvins, neuroprotectins, and maresins.

Dr. Tassos Georgiou in Chap. 20 on the role of omega-3 fatty acids on eye health describes how omega-3 fatty acid supplementation can result in regression in some type of retinopathies, including age-related macular degeneration, macular dystrophies, and also some form of drying eye.

Importance of omega-3 fatty acids in maternal nutrition in growing fetus, reducing the risk of adverse pregnancy outcome, has been reviewed in Chap. 35, by Dr. Sadhana Joshi.

Dr. Gabriel Fernandes, in Chap. 40, describes effect of fish oils on pain resolution, achieving prolonged disease free life.

Obesity leads to several chronic morbidities including type 2 diabetes, atherosclerosis, and hypertension, which are major components of the metabolic syndrome. In chapter 14, Dr. Maria J. Morena Aliaga reviews randomized controlled trials that evaluate the effect of supplementation of EPA and DHA on weight loss, insulin sensitivity, lipid metabolism, blood pressure, and inflammation in subjects with metabolic syndrome characteristics. Dr. Lindsay Brown in Chap. 13 describes linseed as a functional food for the management of obesity. He concludes that there is considerable evidence that the constituents in flaxseed especially ALA and probably also secoisolariciresinol diglucoside and fiber to a lesser extent, either separately or combined, can be defined as functional food, as they may improve the multiorgan changes induced by obesity.

Decrease in the brain DHA content causes number of neurobiological effects including depression. Dr. Beth Levantin in Chap. 22 discusses the evidences that support the involvement of decreased brain omega-3 fatty acids in the etiology of postpartum depression and other depressive disorders and their implications in prevention and treatment.

Dr. Julio Ochoa in Chap. 23 summarizes the role of omega-3 fatty acids in bone health and turnover. In Chap. 24, Dr. Julio Ochoa summarizes the interactive role of Fe and DHA in physiological and nutritional deficiency situations, revealing that DHA stimulates Fe metabolism.

In Chap. 12 on cancer, we discuss the anticancer action of omega-3 fatty acids that may counter the proinflammatory, proangiogenic, and prometastatic and cell proliferative actions of AA eicosanoids and induce apoptosis.

It is no wonder that omega-3 fatty acids are very crucial for our health as they constitute the functional structural component of the membrane and also the precursors of hundreds of eicosanoids and lipid mediators controlling thousands of reactions in human body. Therefore, it is not surprising that the omega-3 deficiency has wide range of adverse effects on different organs and tissues aggravating each and every disease. Therefore, the book also focuses on the means of urgently bringing back omega-3 fatty acids into food chain. These aspects have been very well illustrated by the contributory authors and co-authors of the chapters of the book. We would like to profusely thank them all, being the part of this useful exercise.

Finally, volume editors would like to extend their appreciation to Springer and their staff for providing professional platform for communication with the experts in the field.

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Keys to Nutritional Health

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2016, XXI, 610 p. 95 illus., 69 illus. in color., Hardcover

ISBN: 978-3-319-40456-1