



THE SCIENCE BEHIND OMEGA BLUE™

The Ultimate Health Support

Written By:

Dr. David M. Gundermann, PhD, MSc

Director of Research & Development, Blue Star Nutraceuticals

THE SCIENCE BEHIND OMEGA BLUE™

As a population, the western civilization is lacking a major and critical nutrient that makes a tremendous impact on whole body health, and nobody is exempt. In the category of essential fatty acids, the polyunsaturated fatty acids called omega-3s are the nutrients that are inadequately consumed in the typical diet. Relative to the perceived concern over protein and carbohydrate intake, omega-3s are grossly overlooked as an absolutely necessary nutrient to be concerned about.

Sourced most abundantly in fish, with salmon being the richest in omega-3s, it is assumed that consuming fish is all you need to do to maintain the necessary values of omega-3s. However, farmed raised fish of today have approximately half of the natural omega-3s content than they did less than a decade ago and the trend is continuing to decline.

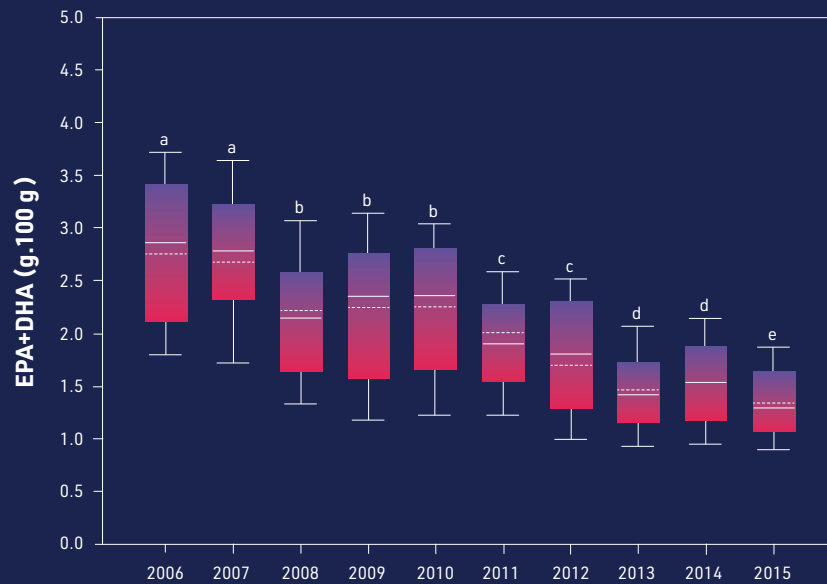


Figure 1. Levels of EPA + DHA in farmed Atlantic Salmon between 2006 and 2015.

Independent of age, sex, and physical fitness nearly everybody can benefit from a fish oil supplement. The trouble is, with so many different fish oil products with different ingredients, different doses and different qualities, it's difficult to know if the product you're taking is giving you the ultimate nutritional advantage.

Omega Blue™ is an industry leader in omega-3 potency and purity in a fish oil supplement. With more than double the EPA and DHA density than the next leading fish oil supplements, and meeting the highest rating in international fish oil standards, Omega Blue™ is the clear choice when trying to optimize the health benefits from fish oil supplementation. However, to fully accept the dire need to supplement omega-3s, a basic understanding of fats is needed.

Fats are Vital for Cellular Functioning

Unlike most other supplements in this industry that are used to simply gain a competitive advantage over non-users, fats are a dietary staple and are essential for human health. Being deficient in certain essential fatty acids, like many are, plays a causal role with many metabolic diseases.

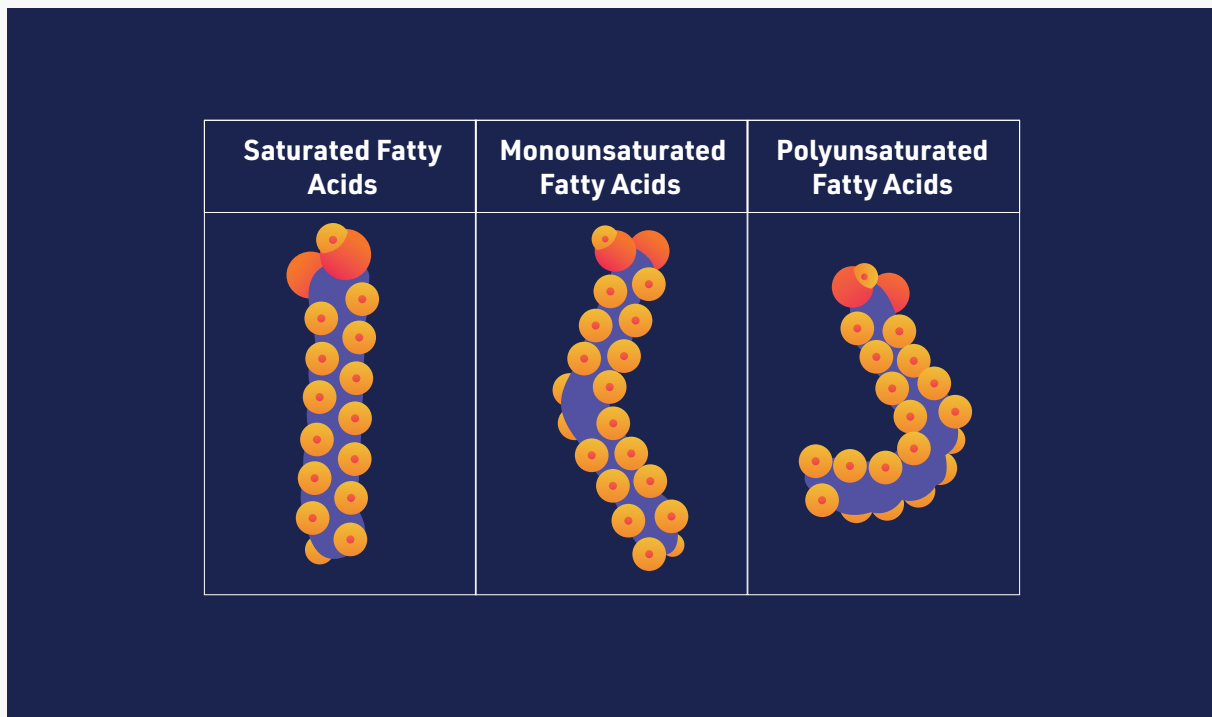


Figure 2. Representative saturated, monounsaturated and polyunsaturated fatty acids.

In the simplest form, fats exist as chains of carbon called fatty acids. Fatty acids provide several vital cellular functions such as protecting vital organs, energy metabolism but most critically, as a prominent structural component to cell membranes.

Overall, fatty acids are roughly divided into three general categories: saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA). These different varieties are distinguished by the presence or absence of double bonds within the carbon chain. SFAs have no double bonds, MUFAs have one double bond and PUFAs have multiple double bonds. While the presence of double bonds does not change the caloric value of the fatty acids, it does drastically alter its shape and many other properties, which is what makes these differences so important. The fatty acid composition of cellular membranes can have a huge effect on a number of metabolic processes such as regulating enzymes and acting as signaling molecules for the cell. For example, a domination of SFA negatively affects cell membrane fluidity and has been linked with the development of obesity, type-II diabetes and metabolic dysfunction. Conversely, the incorporation of MUFAs and PUFAs has positive effects on metabolic functions.

The Essential Fatty Acids

The human body is incapable of producing certain PUFAs and thus these PUFAs are considered essential fatty acids since they need to be included in our diets for survival. In a general sense, there are two major classifications of PUFAs to be concerned about: Omega-3 and Omega-6. The omega-number represents which carbon number from the end the first double bond exists, and thus determines its overall shape and functionalities. Omega-3 fatty acids have double bonds starting at the 3rd carbon, whereas omega-6 fatty acids are saturated until the 6th carbon where the double bonds will start.

YOU SHOULD KNOW

Regardless of age, sex, or physical fitness nearly everybody can benefit from a fish oil supplement. The trouble is, with so many different fish oil products in different doses and different qualities, it's difficult to know if the product you're taking is giving you the nutritional advantage you need. Omega Blue™ is the industry-leader in purity and potency and that's something you can trust.

Both omega-3s and omega-6s in predominantly equal proportions are essential for optimal cellular functioning. However, ever since the agricultural revolution, the western diet consists of as high as 20x the amount of omega-6s compared to omega-3s. This is because omega-6s are widespread and found in vegetable oils, nuts, and seeds, whereas the valuable omega-3s are almost exclusively found in seafood. The rise in the omega-6:omega-3 ratio, ever since the Neolithic era, is correlated with the rise in cardiovascular disease and states of chronic inflammation. Roughly speaking, omega-6s are associated with the production of pro-inflammatory mediators while omega-3 produces inflammatory resolving proteins. Thus, manipulating this ratio may bring about changes in inflammatory balance and

other health outcomes. It's not that omega-6s are fundamentally harmful, but the over abundance of omega-6s will occupy the cellular structures where omega-3s should be functioning and that can have a negative influence on the balance of several cellular functions. There is strong evidence that the type of fat in the diet can play an important role in regulating whole body metabolic health. For example, the traditional diet of Inuit populations (high omega-3s and low omega-6s) is associated with a lowered risk of cardiovascular disease and improved insulin sensitivity despite being a diet very high in fat. Simply increasing dietary intake of omega-3s can effectively displace the over-influence of omega-6s and SFAs.

EPA and DHA Make the Largest Impact

Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are currently thought to be the most bioactive of the omega-3 species in affecting inflammation, metabolic health, and cardiovascular health. Technically, EPA and DHA can both be synthesized from another essential omega-3 called alpha-linolenic acid (ALA), which can be found in the oils of flaxseed, walnuts, canola and soybean. However, the conversion of ALA to either EPA or DHA is so small that more than 97% of ALA remains as ALA and less than 3%, is actually converted to EPA or DHA. Furthermore, the overabundance of omega-6 has actually been shown to further suppress the conversion of ALA resulting in some cases less than 1% of ALA being converted to either EPA or DHA. Research indicates that ALA supplementation alone is insufficient to produce adequate levels of EPA and DHA, which is why fish oil specifically is so critical for many areas of health.

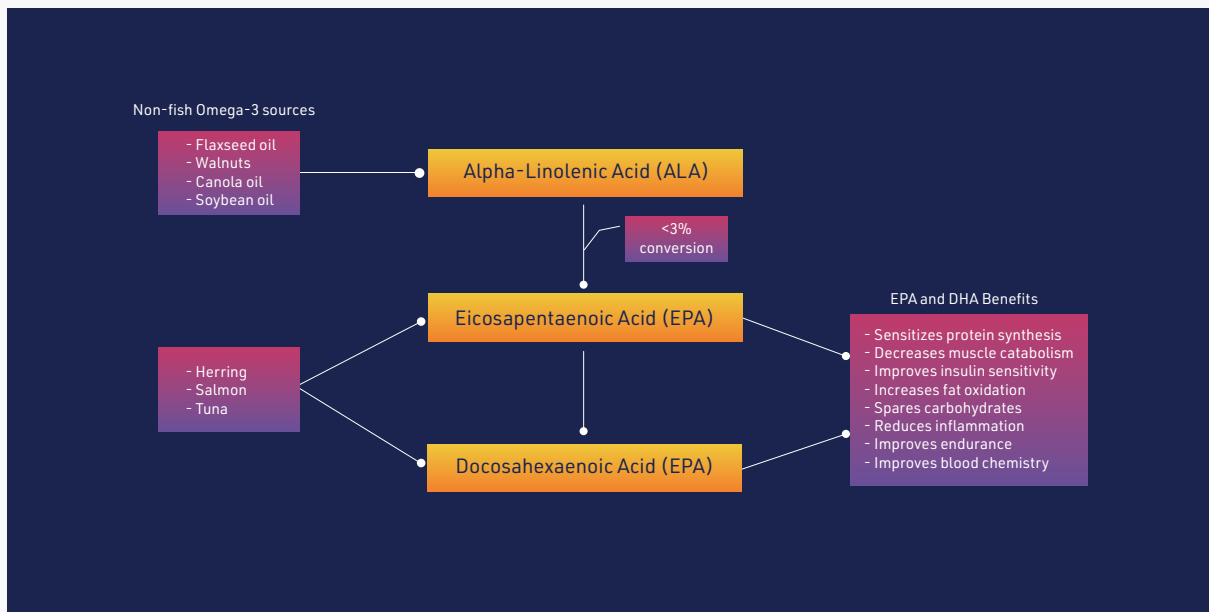


Figure 3. The functional benefits of omega-3 fatty acids related to their source.

Overall Metabolism

Highly unsaturated fatty acids will be most readily burned in the body whereas SFAs are more prone for storage and leading to increased body fat. Therefore, by displacing the SFAs with omega-3s, fat metabolism can be revved up and lead to enhanced fat burning. In a clinical study of healthy individuals, supplementing with omega-3s for 3 weeks increased fat oxidation by 35% at the expense of glucose utilization in response to a bolus of glucose.

The second influence of fat gain is through insulin sensitivity. Any dysfunction of insulin signaling can lead to obesity, insulin resistance, diabetes and ultimately metabolic syndrome. A diet high in SFAs impairs the fluidity of cell membranes and their signaling capabilities. A viscous membrane tightly packed with SFAs is difficult for transport proteins or membrane receptors to move in and out of the membranes. SFAs specifically impair insulin signaling through a mechanism involving a signaling protein called IRS-1. Omega-3s can displace the SFA in muscle cell membranes to help restore the membrane fluidity and the IRS-1 sensitivity. Thus supplementing with omega-3s is especially effective for those with a diet high in saturated fats. Clinical research indicates that EPA at a dose of 1.1 g/day for 3 weeks was shown to reduce insulin secretion and increase fat oxidation in response to either exercise or feeding. This combination of lower insulin secretion levels, improved insulin sensitivity and increased fat oxidation is well suited for both the prevention or treatment of several metabolic diseases.

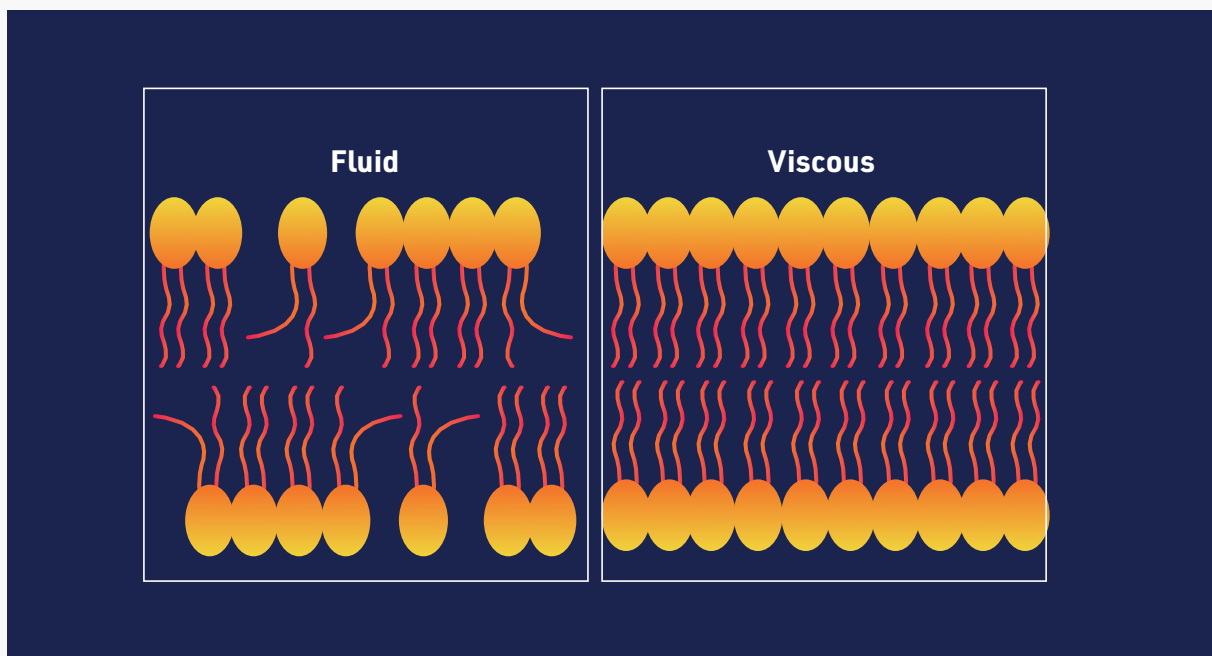


Figure 4. Physical differences of cellular membranes with and without unsaturated fatty acids.

Muscle Health

Recent evidence suggests that manipulating the omega-3 content may improve muscle function and metabolism. There is growing evidence that omega-3s have anabolic and anti-catabolic properties in skeletal muscle. The consensus is that omega-3 supplementation may potentiate the response to other anabolic stimuli via sensitizing the anabolic pathways used for muscle growth. For example, it was observed that omega-3 supplementation led to a greater increase in protein synthesis in response to amino acids and insulin. Investigating this phenomenon using cell-based studies showed that EPA is specifically responsible for the anabolic effects of omega-3s and may also play a role in attenuating the rate of protein degradation. DHA on the other hand, also attenuates protein degradation but with greater efficiency than EPA. Clinical studies have then concluded that 2 g of omega-3s per day when combined with a resistance exercise program lead to significantly improved muscle strength and neuromuscular function. Furthermore, a separate study showed EPA and DHA improves recovery time from exercise as evidenced by attenuating strength loss and limited range of motion between 2 and 5 days after exercise. It is assumed that intake of omega-3s result in an anti-inflammatory response to exercise, which may reduce the symptoms of the delayed onset of muscle soreness. Thus, omega-3s are ideal for those looking to improve musculature.

Evidence suggests that omega-3 supplementation may also improve muscle endurance. Omega-3s have been shown to stimulate mitochondrial biogenesis and thus increase the oxidative capacity of muscle. In a mouse model, EPA was shown to attenuate the age related decline in mitochondrial function through the maintenance of mitochondrial protein quality. This makes supplementing with omega-3s highly attractive for the aging population as well.

Chronic Inflammation

Inflammation is an important process in muscle adaptation. However, failure to resolve inflammation leading to a chronic state of inflammation contributes to insulin resistance, diabetes and obesity. Omega-6 is associated with production of pro-inflammatory mediators while omega-3 has anti-inflammatory properties. Studies have shown that both EPA and DHA can reduce the chronic expression of key pro-inflammatory markers to maintain inflammatory balance. Nearly all of the population can benefit from the reduction of chronic inflammation.

CONCLUSION

Supplementing with omega-3s is not only desirable for bodybuilders or athletes, but rather for nearly all populations, of all genders, health status, activity level and ages. Omega-3 supplementation makes

improvements in protein metabolism, fat metabolism, carbohydrate metabolism, cardiovascular system, immune system, endocrine system and more. There is almost no reason why anybody shouldn't be supplementing with fish oil-derived omega-3s.

The International Fish Oil Standards Program (IFOS™) sets the world's highest standards for purity, potency and freshness when it comes to fish oil. It is important to know that not all fish oil is created equally, and very few are certified by IFOS™.

Omega Blue™ continues to receive a five star rating by IFOS™ with analyses of content, contaminants and stability. Omega Blue™ is one of the purest and most potent source of omega-3s on the current market with 60% of total omega-3s coming from either EPA or DHA. Feel rest assured that Omega Blue™ is always free of contaminants such as heavy metals, PCBs, dioxins, furans and radiation. Finally, unlike many liquid products that are highly susceptible to oxidation when in contact with the air, Omega Blue™ has formidable stability to ensure the last gel cap is as potent as the first.

The combination of all the health benefits from supplementing with fish oil, with the superiority against the competition, Omega Blue™ is the clearest choice to improve overall metabolic health.

A photograph of a man running on a dark sand beach. He is shirtless and wearing dark shorts. In the background, the ocean waves are breaking, and a kite is flying in the sky. The sky is overcast and grey.

Rob Riches

Blue Star Nutraceuticals® Athlete

References

- Andersson A, Nalsen C, Tengblad S, Vessby B. Fatty acid composition of skeletal muscle reflects dietary fat composition in humans. *Am J Clin Nutr.* 76; 1222-1229, 2002.
- Calder PC. Omega-3 fatty acids and inflammatory processes. *Nutrients.* 2; 355- 374, 2010.
- Calder PC. Marine omega-3 fatty acids and inflammatory processes: Effects, mechanisms and clinical relevance. *Biochem Biophys Acta.* 1851; 469-484, 2014.
- Capel F, Acquaviva C, Pitois E, Laillet B, Rigaudiere JP, Jouve C, Morio B. DHA at nutritional doses restores insulin sensitivity in skeletal muscle by preventing lipotoxicity and inflammation. *J Nutr Biochem.* 26; 949-959, 2015.
- Dangardt F, Chen Y, Gronowitz E, Dahlgren J, Friberg P, Strandvik B. High physiological omega-3 Fatty Acid supplementation affects muscle Fatty Acid composition and glucose and insulin homeostasis in obese adolescents. *J Nutr Metab.* 2012; 395757, 2012.
- Delarue J, Couet C, Cohen R, Brechot JF, Antoine JM, Lamisse F. Effects of fish oil on metabolic responses to oral fructose and glucose loads in healthy humans. *Am J Physiol* 270; E353-E362, 1996.
- Esposito K, Marfella R, Ciotola M, Di Palo C, Giugliano F, Giugliano G, Giugliano D. Effect of a Mediterranean-style diet on endothelial dysfunction and markers of vascular inflammation in the metabolic syndrome: A randomized trial. *JAMA.* 292; 1440-1446, 2004.
- Jouris KB, McDaniel JL, Weiss EP. The effect of omega-3 fatty acid supplementation on the inflammatory response to eccentric strength exercise. *J Sports Sci Med.* 10; 432-438, 2011.
- Kamolrat T, Gray SR. The effect of eicosapentaenoic and docosahexaenoic acid on protein synthesis and breakdown in murine C2C12 myotubes. *Biochem Biophys Res Commun.* 432; 593-598, 2013.
- Lanza IR, Blachnio-Zabielska A, Zabielski P, Nair K, Sm Jensen M, Lebrasseur N. Influence of fish oil on skeletal muscle mitochondrial energetics and lipid metabolites during highfat diet. *Am J Physiol Endocrinol Metab.* 304; E1391-E1403, 2013.
- McGlory C, Galloway SDR, Hamilton DL, McClintock C, Breen L, Dick JR, Bell JG, Tipton KD. Temporal changes in human skeletal muscle and blood lipid composition with fish oil supplementation. *Prostaglandins Leukot Essent Fatty Acids* 90; 199-206, 2014.
- Mostad IL, Bjerve KS, Bjorgaas MR, Lydersen S, Grill V. Effects of n-3 fatty acids in subjects with type 2 diabetes: Reduction of insulin sensitivity and time-dependent alteration from carbohydrate to fat oxidation. *Am J Clin Nutr.* 84; 540-550, 2006.
- Phillips T, Childs AC, Dreon DM, Phinney S, Leeuwenburgh, C. A dietary supplement attenuates IL-6 and CRP after eccentric exercise in untrained males. *Med Sci Sports Exerc.* 35; 2032-2037, 2003.
- Schenk S, Saberi M, Olefsky JM. Insulin sensitivity: Modulation by nutrients and inflammation. *J Clin Investig* 118; 2992-3002, 2008.
- Siriwardhana N, Kalupahana NS, Fletcher S, Xin W, Claycombe KJ, QuignardBoulangé A, Moustaid-Moussa N. n3 and n-6 polyunsaturated fatty acids differentially regulate adipose angiotensinogen and other inflammatory adipokines in part via NF-κB-dependent mechanisms. *J Nutr Biochem.* 23; 1661-1667, 2012.
- Smith GI, Atherton P, Reeds DN, Mohammed Bs, Rankin D, Rennie MJ, Mittendorfer B. Omega-3 polyunsaturated fatty acids augment the muscle protein anabolic response to hyperinsulinaemia-hyperanaemia in healthy young and middle-aged men and women. *Clin Sci (Lond).* 121; 267- 278, 2011.

Smith GI, Julliard S, Reeds DN, Sinacore DR, Kein S, Mittendorfer B. Fish oil-derived n-3 PUFA therapy increases muscle mass and function in healthy older adults. *Am J Clin Nutr.* 102; 115-122, 2015.

Sprague M, Dick JR, Tocher DR. Impact of sustainable feeds on omega-3 longchain fatty acid levels in farmed Atlantic salmon, 2006-2015. *Sci Rep.* 6; 21892, 2016.

Stubbs CD, Smith AD. Essential fatty acids in membrane: Physical properties and function. *Biochem Soc Trans.* 18; 779-781, 1990.

Taribian B, Maleki BH, Abbasi A. The effects of ingestion of omega-3 fatty acids on perceived pain and external symptoms of delayed onset muscle soreness in untrained men. *Clin J Sport Med.* 19; 115-119, 2009.

Wang Y, Lin Q, Zheng P, Zhang J, Huang F. DHA inhibits protein degradation more efficiently than EPA by regulating the PPAR γ /NF κ B pathway in C2C12

©2022, Blue Star Nutraceuticals Inc. No part of this material may be reproduced in any form, or referred to in any other publication, without the express written permission of Blue Star Nutraceuticals Inc. ("Blue Star Nutraceuticals"). You agree to indemnify and hold Blue Star Nutraceuticals®, its parent, subsidiaries, affiliates, directors, officers and employees, harmless from any claim, demand, or damage, including reasonable attorney fees, asserted by any third party or arising out of your use of this document, product, and/or website.

These statements in this document have not been evaluated by the Food and Drug Administration, or Health Canada, The information presented in this document is by no way intended as medical advice or as a substitute for medical counselling. Consult your physician before following any information presented in this document. The products recommended and information presented are not intended to treat, diagnose, cure, or prevent any disease. This document and Blue Star Nutraceuticals® are protected by copyright law and international treaty provisions and may not be copied or imitated in whole or in part. No logo, trademark, graphic or image from this document or Blue Star Nutraceuticals® may be copied or retransmitted without the express written permission of Blue Star Nutraceuticals®.

The information provided is for informational purposes only and is subject to change without notice. This report does not constitute, either explicitly or implicitly, any provision of services or products by Blue Star Nutraceuticals, and readers should determine for themselves whether or not the information herein is suitable for their needs.



About The Author

Dr. David Gundermann is an award winning nutritional product development scientist, clinical researcher, and known expert in muscle health and metabolism. He developed his passion for health & fitness at a very early age growing up in a family of accomplished competitive athletes.

As Director of Research and Development at Blue Star Nutraceuticals®, he leads all efforts concerning product formulation, key ingredient research, flavor science, long-term scientific assessment, and proprietary development.

Dr. David Gundermann, PhD, MSc

Blue Star Nutraceuticals Inc.
3-5 Edinburgh Road South
Guelph, Ontario, N1H 5N8

info@bluestarnutraceuticals.com
www.bluestarnutraceuticals.com