Journal of Health Care and Research

Commentary

DOI: https://doi.org/10.36502/2020/hcr.6172

Functions of Omega-3 and Omega-6 in Prevention and Fighting Cardio-Metabolic Complications

Halim M[1*], Halim A[2**]

[1]*University of Salford, MSc Biomedical Science, Greater Manchester, United Kingdom*

[2]*Zhong Shan Hospital, Shanghai Medical College, Fudan University, Shanghai, China*

Corresponding Author(s): **Michael Halim*** and **Alice Halim****

***Address:** University of Salford, MSc Biomedical Science, Greater Manchester, United Kingdom; Email: michaelhalim1000@gmail.com

****Address:** Zhong Shan Hospital, Shanghai Medical College, Fudan University, Shanghai, China; Email: alicehalim95@gmail.com

Received date: 23 July 2020; **Accepted date**: 26 August 2020; **Published date**: 15 September 2020

Citation: Halim M, Halim A. Functions of Omega-3 and Omega-6 in Prevention and Fighting Cardio-Metabolic Complications. J Health Care and Research. 2020 Sept 15;1(3):144-48.

Abstract

Background: Cardio-metabolic disease is one of the deadliest diseases responsible for the current mortality and morbidity cases. Smoking, drinking alcohol, poor diet, sedentary activities, and malnutrition are some of the modifiable behaviors attributed to the cardio-metabolic disease. Improving dietary operations helps in the eradication of cardio-metabolic complications because the consumption of a balanced diet improves the pleiotropic functioning of cells. It also regulates the inflammatory as well as properties that are against inflammatory acids in the cardiovascular protection process. The purpose of this research is to study the function of Omega-3 and Omega-6 single-chain lipids acids in enhancing cardio-metabolic health.

Methodology: Researchers visited several medical databases required in the acquisition of relevant information and analysis to evaluate the functional importance and effectiveness of Omega-3 and Omega-6 single-chain lipids in the prevention of cardio-metabolic complexions.

Results: The findings of the research, as mentioned above process, showed that Omega-3 and Omega-6 acids keep the cells off from contracting cardio-metabolic complications. They perform this operation by lowering the inflammatory index of arteries, reducing blood clotting, and decreasing the level of low-density lipoproteins in the body.

Conclusion: Polyunsaturated fatty acids (PUFAs) protect the body from cardio-metabolic risk. The human diet should have the right constituent of PUFAs to increase the concentration of single-chain lipids required to protect cardio-metabolic disease in the body.

Keywords

Omega-3, Omega-6, Polyunsaturated Fatty Acids, Cardio-metabolic Health, Inflammation

Commentary

Introduction

Definition, Causes, and Examples:

The commentary points out that cardio-metabolic health complications include cardiovascular diseases such as heart failure, cardiomyopathy, and heart attack, as well as metabolic disorders such as stroke and obesity [1]. Hypertension, poor glucose intolerance, resistance to insulin, dyslipidemia, and central adiposity are the main characteristics of cardio-metabolic disease [2]. Vincent et al. [3] illustrate that cardiovascular complications are characterised by poor or short sleeping patterns, poor diets, as well as little or no physical body activities [4], which result in complications such as high blood pressure and obesity [5]. PUFAs are fatty acids that have a composition of two or more double bonds in their chemical structure such as Omega-6 and Omega-3 [6]. PUFAs are commonly obtained in dietary foods to enhance cardiometabolic protection of the body.

Methodology

To evaluate the importance of Omega-6 and Omega-3 PUFAs in the prevention of cardio-metabolic complications, researchers acquired relevant information and analyses from a range of medical databases, incorporating several keywords such as multi-unsaturated single-chain lipids, cardio-metabolic curation, Omega-3, Omega-6, and inflammation, among other relevant terms to this study [7]. or accuracy, efficiency, and reliability of outcome, researchers applied an automated technology regarding, employing inclusion and exclusion critique to improve the research process, reduce human effort, and arrive at objectives quickly [8].

Results

Different PUFAs have different impacts on the ability of the body to fight cardio-metabolic dysfunctions. Findings indicated the replacement of "saturated fatty acids with unsaturated fatty acids" in our dietary activities is necessary for fighting cardio-metabolic dysfunction [9]. In a statement, Clifton et al. [10] argue that foods rich in Omega-3 and Omega-6 are rich in PUFAs that provides required defense against cardio-metabolic dysfunctions.

Omega-3 and Omega-6 are also useful in regulating platelets and functional thrombosis [11]. From the findings, a combination dose of Omega-3, rich in PUFAs such as EPA and DHA that contain a composition of heart regulons can last up to several months, and that triglycerides lower the impact of cardiovascular dysfunction up for to one year.

Effects of Omega-3 and Omega-6 on inflammation and Cardio-metabolic Health:

One critical point to consider According to [12], inflammation protects against infections and injuries hence vital for survival, although an excess of it is harmful. The effect of Omega-3 and Omega-6 has antithrombotic properties, and pharmaceutical and therapeutic strategies would be useful in establishing the link between inflammation and cardio-metabolic diseases [13]. The review article claims that diet is essential for inflammation due to substances like cytokines that contribute to cardio-metabolic diseases. Kinds of seafood like Eskimos are rich in PUFAs that are important for body defense against cardio-metabolic complications. Omega-6 and Omega-3 supplements can as well be manufactured from laboratories and sold as pharmaceutical medicine. Sufficient consumption of foods rich in PUFAs, such as Omega-3 and Omega-6, influences the occurrence of inflammation in the body as well as cardio-metabolic health status in individuals [14].

Impact of Omega-6 and Omega-3 in Thrombogenesis:

Inflammation and oxidative processes are related to thrombosis, as illustrated by **Table-1** below:

Table-1: Effects of EPA and DHA on thrombogenesis [12]

Clotting and endothelial	EPA	DHA
Clotting	Reduces coagulation of platelets.	Reduces platelet aggregates stimulated by collagen
Endothelial Function	limits cases of inflammation and oxidative stress	Improves immunity by reducing inflammation and oxidative stress

Commentary

According to the commentary **Table-1** above, EPA and DHA improve thrombogenesis and inflammatory immunity by reducing catalytic production of thrombin. Reduced output of thrombin under the inhibition activity of EPA and DHA translates to a reduction in platelet coagulation, which leads to reduced inflammation and oxidative stress in endothelial [15]. Similarly, thrombin inhibition activity of EPA and DHA would eradicate the coagulation process, reducing collagen-stimulated aggregates of platelets in the system. The reduced collagen-stimulated aggregates of platelets lead to reduced inflammation and oxidative stress. In other biological mechanisms, EPA and DHA play a significant role in cardio-protection, regulation of antiarrhythmic effects, and stabilizing myocardial efficiency.

The reviewers argue that high levels of polyunsaturated fatty acids replace arachidonic acid levels in the phospholipid membrane [9], which, in turn, decreases the binding process and synthesis of thromboxane. During this process, an additional output of thromboxane-A3 exerts some profound biological effects on the body compared to thromboxane A2. This process limits the activity of cyclo-oxygenase-1 and cyclo-oxygenase-2 in the neutrophils and platelet structures promoting aggregation processes, as indicated by **Fig-1** [12].

Vitro and Vivo results indicate that supplementation of additional PUFAs affects the reduction of thromboxane type 2 synthesis [11]. The reduction of thromboxane type leads to adhesion as well as activation and reduction in the concentration of plasminogen activator inhibitor-1. Polyunsaturated fatty acids exhibit antithrombotic properties [15]. More precise analysis and effectiveness of Omega-3 PUFAs on thrombogenesis can be illustrated in a platelet model of the blood clotting process.

Omega-3 PUFAs impart their control of the role of curbing thrombogenesis using two key processes; replacing the arachidonic monomers in the to reduce the effect of COX-1 on the thrombogenesis effect and activation of TXA2 antagonist synthesis of protein DX to lipoxygenase catalase, responsible for the synthesis of inhibitors COX-1 and COX-2 [16].

More effective and common PUFAs like EPA and DHA have a favorable implication on the replacement process of arachidonic acid inside the membrane of the phospholipid structure.

The effects of DHA and EPA indicated a small and minimal impact on the thrombogenesis processes and were portrayed by their inability to trigger the platelet coagulation. Similarly, DHA and EPA showed the capacity to reduce inflammation and oxidative stress [17].

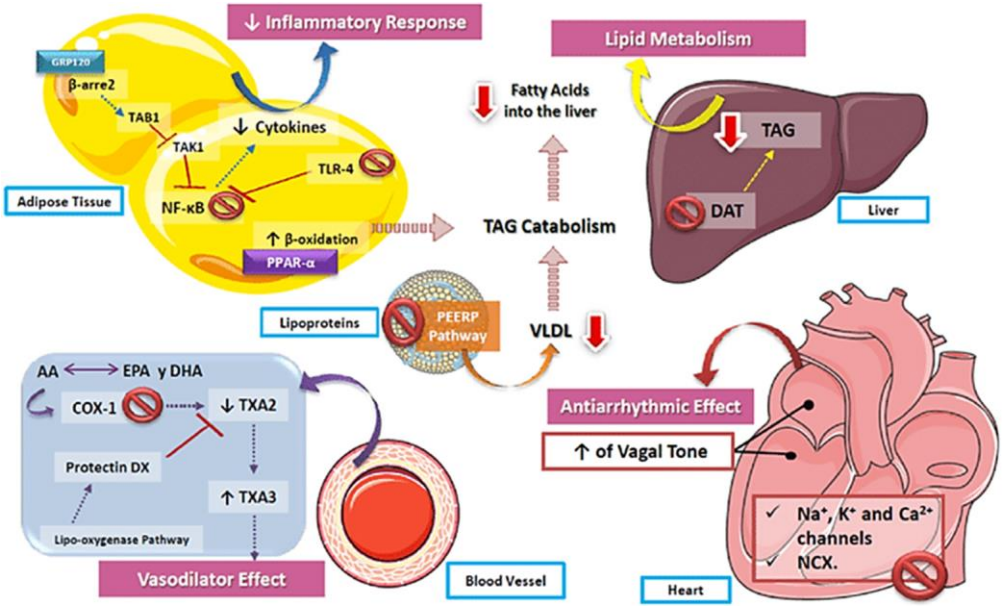

Fig-1: Role of PUFAs on thrombogenesis

The cell metabolic structure is related to blood dislodge and squamous operation. According to [17], improved effects of EPA and DHA on the endothelial membrane improve the operational efficiency of arteries. However, the impact on the above-mentioned PUFAs on veins is quite uncertain.

Different research depicted by [17] shows that these two PUFAs can control thrombogenesis by acting as TGH2 and TXA2 antagonists in the production of DX since DHA is manufactured based on the LOX, which can inhibit COX-1 and COX-2. Over time, the human being has associated thromboembolism with endothelial function [15].

Conclusion

It should be noted that cardio-metabolic diseases contribute to high mortality and morbidity rates across all ages, races, and genders, and have become a burden to health and economy worldwide. Changes in lifestyle behaviours and dietary are useful preventive and management measures to these complications. Omega-3 PUFAs are essential in the reduction of and prevention of inflammation agents and cardiovascular diseases like thrombosis, while Omega-6 PUFAs lower cholesterol levels hence promoting cardiovascular health, although it is not clear as to whether Omega-6 PUFAs cause inflammation or not, with the release of inflammatory molecules like leukotrienes during its formation. Therefore, more research is necessary on the link between Omega-6 and inflammation.

References

[1] Forouhi NG, Krauss RM, Taubes G, Willett W. Dietary fat and cardiometabolic health: evidence, controversies, and consensus for guidance. BMJ. 2018 Jun 13;361:k2139. [**PMID**: 29898882]

[2] Abdelhamid AS, Martin N, Bridges C, Brainard JS, Wang X, Brown TJ, Hanson S, Jimoh OF, Ajabnoor SM, Deane KH, Song F, Hooper L. Polyunsaturated fatty acids for the primary and secondary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2018 Jul 18;7(7):CD012345. [**PMID**: 30019767]

[3] Vincent GE, Jay SM, Sargent C, Vandelanotte C, Ridgers ND, Ferguson SA. Improving Cardiometabolic Health with Diet, Physical Activity, and Breaking Up Sitting: What about Sleep? Front Physiol. 2017 Nov 8;8:865. [**PMID**: 29167645]

[4] Van Elten TM, Van Poppel MNM, Gemke RJBJ, Groen H, Hoek A, Mol BW, Roseboom TJ. Cardiometabolic Health in Relation to Lifestyle and Body Weight Changes 3–8 Years Earlier. Nutrients. 2018 Dec 10;10(12):1953. [**PMID**: 30544716]

[5] Kivimäki M, Kuosma E, Ferrie JE, Luukkonen R, Nyberg ST, Alfredsson L, Batty GD, Brunner EJ, Fransson E, Goldberg M, Knutsson A, Koskenvuo M, Nordin M, Oksanen T, Pentti J, Rugulies R, Shipley MJ, Singh-Manoux A, Steptoe A, Suominen SB, Theorell T, Vahtera J, Virtanen M, Westerholm P, Westerlund H, Zins M, Hamer M, Bell JA, Tabak AG, Jokela M. Overweight, obesity, and risk of cardiometabolic multimorbidity: pooled analysis of individual-level data for 120 813 adults from 16 cohort studies from the USA and Europe. Lancet Public Health. 2017 May 19;2(6):e277-e285. [**PMID**: 28626830]

[6] Brown TJ, Brainard J, Song F, Wang X, Abdelhamid A, Hooper L; PUFAH Group. Omega-3, omega-6, and total dietary polyunsaturated fat for prevention and treatment of type 2 diabetes mellitus: systematic review and meta-analysis of randomised controlled trials. BMJ. 2019 Aug 21;366:l4697. [**PMID**: 31434641]

[7] Gambardella J, Santulli G. Integrating diet and inflammation to calculate cardiovascular risk. Atherosclerosis. 2016 Oct;253:258-61. [**PMID**: 27594541]

[8] Al-Khudairy L, Hartley L, Clar C, Flowers N, Hooper L, Rees K. Omega 6 fatty acids for the primary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2015 Nov 16;(11):CD011094. [**PMID**: 26571451]

[9] Maki KC, Eren F, Cassens ME, Dicklin MR, Davidson MH. ω-6 Polyunsaturated Fatty Acids and Cardiometabolic Health: Current Evidence, Controversies, and Research Gaps. Adv Nutr. 2018 Nov 1;9(6):688-700. [**PMID**: 30184091]

[10] Clifton PM, Keogh JB. A systematic review of the effect of dietary saturated and polyunsaturated fat on heart disease. Nutr Metab Cardiovasc Dis. 2017 Dec;27(12):1060-80. [**PMID**: 29174025]

[11] Adili R, Hawley M, Holinstat M. Regulation of platelet function and thrombosis by omega-3 and omega-6 polyunsaturated fatty acids. Prostaglandins Other Lipid Mediat. 2018 Nov;139:10-18.

[**PMID**: 30266534]

[12] Donath MY, Meier DT, Böni-Schnetzler M. Inflammation in the Pathophysiology and Therapy of Cardiometabolic Disease. Endocr Rev. 2019 Aug 1;40(4):1080-91. [**PMID**: 31127805]

[13] Ely BR, Clayton ZS, McCurdy CE, Pfeiffer J, Minson CT. Meta-inflammation and cardiometabolic disease in obesity: Can heat therapy help? Temperature (Austin). 2017 Nov 10;5(1):9-21. [**PMID**: 29687041]

[14] Thota RN , Ferguson JJA , Abbott KA , Dias CB , Garg ML . Science behind the cardio-metabolic benefits of omega-3 polyunsaturated fatty acids: biochemical effects vs. clinical outcomes. Food Funct. 2018 Jul 17;9(7):3576-96. [**PMID**: 29904777]

[15] Sokoła-Wysoczańska E, Wysoczański T, Wagner J, Czyż K, Bodkowski R, Lochyński S, Patkowska-Sokoła B. Polyunsaturated Fatty Acids and Their Potential Therapeutic Role in Cardiovascular System Disorders-A Review. Nutrients. 2018 Oct 21;10(10):1561. [**PMID**: 30347877]

[16] Byrnes JR, Wolberg AS. New findings on venous thrombogenesis. Hamostaseologie. 2017 Jan 31;37(1):25-35. [PMID: 27878206]

[17] Dyall SC. Long-chain omega-3 fatty acids and the brain: a review of the independent and shared effects of EPA, DPA and DHA. Front Aging Neurosci. 2015 Apr 21;7:52. [**PMID**: 25954194]