

The Role of Omega-3 Fatty Acids in Depression Management

Iqra Asghar^{1*}, Sonia Qurban², Maria Qandeel³, Laiba Sabir⁴ and Dua Noor⁵

1. National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan.
2. Department of Pharmacy, Faculty of Medical Sciences, Government College University Faisalabad, Pakistan.
3. Department of Human Nutrition and Dietetics, University of Agriculture Faisalabad, Constituent College Toba Tek Singh, Pakistan.
4. Department of Nutrition & Health Promotion, University of Home Economics Gulberg Lahore, Pakistan.
5. Department of Human Nutrition and Dietetics, Muhammad Nawaz Sharif University of Agriculture Multan, and Nishter Medical University, Pakistan

*Corresponding Author: Iqrasghar7890@gmail.com

ABSTRACT

Depression is a mental disorder with long-term sadness, loss of interest in activities, and low energy. This led researchers to focus on nutritional factors, including omega-3 polyunsaturated fatty acids (PUFA) known as a complementary approach for managing depression. Omega-3, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), can improve mood through interconnected pathways, such as reducing brain inflammation (by lowering arachidonic acid (AA) in cell membranes, which produces inflammatory chemicals), reducing oxidative stress, and supporting neurotransmitter function. Clinical trials, as shown in meta-analyses, indicate that a 1-2 g daily dose of omega-3, especially with 60% EPA, yields good results in lowering depressive symptoms when combined with antidepressants. Results are particularly high for patients with inflammatory markers present in the brain. However, outcomes are not consistent due to differences in dosages, trial design, and formulation. Collectively, omega-3s show effective, low-risk, evidence-based adjuncts in depression management but with a combination of antidepressants.

Keywords: omega-3, EPA, DHA, depression, mental health

To cite this article: Asghar I, S Qurban, M Qandeel, L Sabir & D Noor. The Role of Omega-3 Fatty Acids in Depression Management. Biological Times. 2026. August 5(8): 27-28.

Introduction

Depression stands as a primary contributor to disability worldwide, which is a severe condition that affects the quality of life. Approximately 350 million people are affected worldwide; about 4.3% of the economic burden of the world population rises and continues to rise [1]. Not only individually, but it affects families, communities, social circles, and overall economic productivity [2,17]. Most of the depression cases begin from childhood to adulthood. According to research, about 25% of teenagers are experiencing depression episodes. In pre-adulthood, depressive episodes often predict challenges in their relationships, academics, career, low quality life. It increases the chances of self-harm and suicide [2]. According to WHO, currently 280 million people are suffering from depression, of whom 75% don't get treatment and who belong to low- or middle-income countries [3].

Omega-3 fatty acids have all three essential amino acids, such as EPA, DHA and ALA, which have multiple double bonds [4]. These are well known for their therapeutic potential in treating depression and other mental disorders. About 50-60% of the human brain is made of lipids, of which 35% is omega-3 PUFA. More than 40% of the brain neural tissues have DHA. Rapid accumulation of DHA occurs in the brain in the last stage of pregnancy and the first 18 months of the newborn [5]. Existing evidence shows that omega-3 PUFA can exert an antidepressant effect while preserving the blood-brain barrier [6].

Lifestyle interventions have the potential to be used as an alternative to pharmacotherapy. Omega-3 supplementation is already frequently tested in adults and has shown significant good results in reducing depression. The primary aim is to investigate the effect of PUFA in treating depression. The second aim is to explore the PUFA effect on cognitive functions. However, the evidence have limitations. Study results are inconsistent due to the variety in dosage of EPA and DHA and the duration of the treatments, which makes it difficult to build clinical guidelines [7].

Omega-3 and brain function:

DHA have 22 carbon atoms long chain PUFA consist of six cis double bonds and a terminal carboxyl moiety. In mammals diet, a high amount of DHA is present, especially in seafood like krill oil and fatty fish. Another good source is breast milk; DHA can be synthesized from ALA in a massive amount, with around 0.5% of the total DHA amount being the conversion rate in humans [8]. Various sources of omega-3 are available; predominantly EPA and DHA are present in oily fish in cold water, considered a good source [9].

Basically, omega-3 fatty acids keep the cell membrane flexible, maintaining membrane fluidity, which make easy for serotonin and dopamine to send and receive signals and bind properly with their receptors. As serotonin is responsible for feeling good and dopamine is responsible for pleasure and

motivation, impaired signaling in these, while low omega-3 fatty acids, will disturb membrane fluidity and make signaling difficult. It is linked with contributing to depression symptoms [10].

Omega-3 PUFA is considered a preventive measure for depression and also works well in its treatment due to its anti-inflammatory properties [18]. In omega-3 PUFA, there are particularly EPA and DHA, well-known for having anti-inflammatory properties; these two are most valuable in managing depression. Basically, in our diet, omega-3 goes into our cell membrane where it replaces arachidonic acid (AA), which is an inflammatory compound. AA is later converted into substances like prostaglandins, thromboxanes, and leukotrienes [11]. These substances cause inflammation in the body when omega-3 takes the place of AA in the cell membrane, so fewer inflammatory compounds will be produced, and less inflammation will occur. Furthermore, it not only replaces the raw material of inflammation, but it also helps the body to make molecules like protectines, marisines and resolvins, which is known as pro-resolvers. These pro-resolvers help in eliminating the already existing inflammation in the body in three way first it blocks all the inflammatory substances to release, stop the cells from rushing to the inflammatory site, and help in clearing away all the debris from the inflammatory site [11].

Mechanism: how omega-3 fatty acids influence mood

By consuming omega-3 fatty acid there is an effective decrease in depression due to its anti-inflammatory and neuroprotective properties that improve individuals both mental and emotional health [12,18]. There are four brain chemicals which is regulated by omega-3 PUFA, like serotonin (a feel-good chemical play role in emotion and calmness), Dopamine (helps in regulating motivation, pleasure, and reward), norepinephrine (an alertness and stress hormone), and endocannabinoids (a female hormone that regulates mood and stress). Omega-3 fatty acids regulate the cell membrane fluidity, which allows serotonin and dopamine to bind with the receptors. If there is low omega-3 fatty acid, then cell membrane fluidity will be disturbed, and there will be no binding with receptors, with worse symptoms of depression [10]. EPA and DHA act as an antidepressant by biological pathways interconnection which links biological biomarkers to cellular processes and clinical outcomes [12].

Key roles of omega-3 makes brain signaling smoother: omega-3 maintains the cell membrane fluidity, makes it function properly, and binds the receptors. Specifically serotonin and dopamine systems. Anti-inflammatory action: lowers the inflammatory markers; it also reduce microgilla overactivation, which play major role in depression. Reduce oxidative stress: omega-3s neutralize reactive oxidative species, which are harmful molecules, making the body's natural antioxidative system stronger, so no oxidative damage will occur to brain cells [12].

Clinical evidences:

Five observational studies have done that noted the omega-3 supplementation reduces the symptoms of depression. Most effective is EPA supplementation in subgroup analysis, reducing symptoms with severe to moderate depression [13]. According to another study, the higher dose of EPA 1g/day is very effective in reducing depressive disorder with high levels of inflammatory markers and cardiac disease. Omega-3 supplementation has high potential benefits in cognitive, mood, and metabolic function [14].

In older adults, according to a meta-analysis in randomized control trials shows result in, omega-3 supplementation has a great effect on cognitive performance. But some other studies show great synaptic effects. There are also some studies that show no effect of omega-3 PUFA [9]. In children, low erythrocyte DHA is found in recent neuroimaging with is related to the reduce function connectivity with the prefrontal network. Some studies show omega-3 PUFA high affinity in depression influenced with its dosage and proportion of EPA and DHA, their ratio should be 3:1 or 2:1 of EPA and 1g/day or 2g/day for DHA is more effective [15].

Over the past 20 years, research has focused on omega-3 PUFA on depression, bipolar disorder, and other disorders. It is proven that 60% of EPA of total omega-3 works better than DHA. The results are more effective when EPA is combined with antidepressants. Without antidepressants alone, omega-3 just gives anti-inflammatory results. It matters what you are taking alongside of supplements [13].

Conclusion

In this article, we have focused on the effects of omega-3 PUFA on treating depression. It manages depression symptoms through interconnected pathways like supporting neurotransmitter functions, reducing brain inflammation, and reducing oxidation reactions. It is proven by experiments over two decades that omega-3 have EPA and DHA, most particularly effective one is EPA. Different studies use different ratios of EPA and DHA. The most effective way is to use 1g or 2g of DHA with an EPA ratio of 2:1 or 3:1. It only works well with antidepressants. We can't replace antidepressants with omega-3 supplements, but it can make the symptoms less severe. These supplements are effective in severe to moderate depression in adults and children. The research gap is omega-3 supplement dosage and its proportion in treating depression.

We need more standardized clinical trials on a larger scale to identify what dose for which patient would be suitable in the long term. But in the future, as research advances, more personalized treatment and inflammation-informed treatment approaches will be used. Omega-3 fatty acids have potential for evidence-based treatment in routine treatment care, in combination with professional treatment rather than replacing it.

References

- [1] Yin Y, Jug T, Zing D, Duane F, Zhu Y, Liu J, Li Y, Lu W. "Inflamed" depression: A review of the interactions between depression and inflammation and current anti-inflammatory strategies for depression. *Pharmacological Research*. 2024 Sep 1;207:107322.
- [2] Lu B, Lin L, Su X. Global burden of depression or depressive symptoms in children and adolescents: A systematic review and meta-analysis. *Journal of Affective Disorders*. 2024 Jun 1;354:553-62.
- [3] Rong J, Cheng P, Li D, Wang X, Zhao D. Global, regional, and national temporal trends in prevalence for depressive disorders in older adults, 1990–2019: An age-period-cohort analysis based on the Global Burden of Disease Study 2019. *Ageing Research Reviews*. 2024 Sep 1;100:102443.
- [4] Zailani H, Satyanarayanan SK, Liao WC, Liao HF, Huang SY, Galecki P, Su KP, Chang JP. Omega-3 polyunsaturated fatty acids in managing comorbid mood disorders in chronic obstructive pulmonary disease (COPD): a review. *Journal of Clinical Medicine*. 2023 Apr 2;12(7):2653.
- [5] Dighirri IM, Alsubaie AM, Hakami FM, Hamithi DM, Alshekh MM, Khobrani FA, Dalak FE, Hakami AA, Alsueaadi EH, Alsaawi LS, Alshammari SF. Effects of omega-3 polyunsaturated fatty acids on brain functions: a systematic review. *Cureus*. 2022 Oct 9;14(10).
- [6] Zailani H, Wang WL, Satyanarayanan SK, Chiu WC, Liu WC, Sung YS, Chang JP, Su KP. Omega-3 polyunsaturated fatty acids and blood-brain barrier integrity in major depressive disorder: restoring balance for neuroinflammation and neuroprotection. *The Yale Journal of Biology and Medicine*. 2024 Sep 30;97(3):349.
- [7] Norouziasl R, Zeraattalab-Motlagh S, Jayedi A, Shab-Bidar S. Efficacy and safety of n-3 fatty acids supplementation on depression: a systematic review and dose-response meta-analysis of randomised controlled trials. *British Journal of Nutrition*. 2024;131(4):658–71. doi:10.1017/S0007114523002052
- [8] Petermann AB, Reyna-Jeldes M, Ortega L, Coddou C, Yévenes GE. Roles of the unsaturated fatty acid docosahexaenoic acid in the central nervous system: molecular and cellular insights. *International Journal of Molecular Sciences*. 2022 May;23(10):5390.
- [9] Kousparou C, Fyrrilla M, Stephanou A, Patrikios I. DHA/EPA (omega-3) and LA/GLA (omega-6) as bioactive molecules in neurodegenerative diseases. *International Journal of Molecular Sciences*. 2023 Jun;24(13):10717.
- [10] Zhou L, Xiong JY, Chai YQ, Huang L, Tang ZY, Zhang XF, Liu B, Zhang JT. Possible antidepressant mechanisms of omega-3 polyunsaturated fatty acids acting on the central nervous system. *Frontiers in Psychiatry*. 2022;13:933704.
- [11] Malau IA, Chang JPC, Lin YW, Chang CC, Chiu WC, Su KP. Omega-3 fatty acids and neuroinflammation in depression: targeting damage-associated molecular patterns and neural biomarkers. *Cells*. 2024;13(21):1791.
- [12] Liscano Y, Sánchez-Palacio N. A critical look at omega-3 supplementation: a thematic review. *Healthcare*. 2023;11(23):3065.
- [13] Lastretti M, Campedelli L, Scarpato T, Spagna S, Cicoli A, Faa G, D'Aleo E. Omega-3 fatty acids and mood disorders: a critical narrative review. *Lipidology*. 2026;3(1):2.
- [14] Idowu O, Aderinto N, Olatunji G, Kokori E. The Efficacy of Omega-3 Fatty Acid Supplementation for Major Depressive Disorder in Adults: A Systematic Review and Meta-Analysis. *BJPsych Open*. 2025;11(S1):S43–4. doi:10.1192/bjo.2025.10147
- [15] Su KP, Dyal SC, Malau IA. Omega-3 polyunsaturated fatty acids in depression: insights from recent clinical trials. *Current Opinion in Clinical Nutrition & Metabolic Care*. 2024;28(2):66-74.
- [16] Tanu T, Mann SK, Kaur MN, Raman M. The role of omega-3 fatty acids in the treatment of depression in children and adolescents: a literature review. *Cureus*. 2023;15(9).
- [17] Ashraf MA, Afzal MA, Ijaz M, Arshad A, Zafar MN, Ukkasha SM, Zahid I. Financial impact of nutrition on non-communicable diseases in hospital or other healthcare settings. *Biological Times*. 2025 Sep 4;4(9):20-1.
- [18] Afzal MA, Noor N, Sajjad I, Asghar M, Awais M, Aslam A, Mukhtar E, Afzal ZP, Tariq N, Batool H. Effects of meat consumption on human health: Nutritional benefits, associated risks, and implications for dietary recommendations. *Continental Veterinary Journal*, x. 2026.