



Polyunsaturated Fatty Acids (ω -3 fatty acids): A Ray of Hope in the Management of Cognitive Dysfunctioning and Neurodegeneration

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Abstract

Polyunsaturated fatty acids (ω -3 fatty acids) have been related to healthy ageing all over life. A moment ago, from fish source ω -3 fatty acids DHA and EPA have been linked to fetal development in AD and cognition related problems. However, since human body does not effectively produce few ω -3 fatty acids, which obtain from marine sources. The brain is extremely augmented with lipid bilayers. Thus, it is accountable to undertake that the compounding of different fatty acids within brain has importance for the brain functioning, counting neuropsychiatric and cognition development. To know the special effects from fatty acid consumption, we required to depend along the mutual evaluation of observational studies, observations and Interventional studies. The brain is enriched with lipid bilayers of ω -3 fatty acid constituents like DHA and EPA may cause heaps of effects on the mentality. The potential function of ω -3 fatty acids, DHA and EPA in the suppression of cognitive degeneration, including AD have involved key importance for the past two decades. Additionally, AD has delivered the utmost positive sign to backing the situation that inflammation contributes to neurodegenerative disorder. It is assumed that primarily, management or prevention of inflammation may delay the indications of AD. Ordinarily, switches the brain physiology with increased age, making up a reduction of elongated chain ω -3 fatty acids and brain of AD patients have reduced the DHA presence. Provided supplementary DHA can decrease the indications of inflammations. The health related benefits of ω -3 fatty acids are very appreciable. Currently, there is no any evidence of maintenance or confirmation of that modifiable risk parameters like herbal medicines, nutritional supplements, modified diet etc. Are associated with reduced the risk elements of AD or the cognition failure. Even though, multiple studies are demonstrating that lifestyle and diet related parameters are the chief risk factors for AD and cognition behavior. This chapter basically

focused on the different functions of ω -3 fatty acids, mainly DHA and EPA in different neurodegenerative diseases and disorders.

Keywords – Cognitive dysfunctioning, Eicosapentaenoic acid, neurodegeneration, Docosahexaenoic acid

1. Introduction to cognitive disorder

Cognitive disorder is a major upset in public due to deficiency of quality of lifestyle in day-to-day life. These disorders observed in aged populations associated with Alzheimer disease (AD). Globally 35.6 population suffering from Dementia and among that 88% of the population is linked up with partially Dementia also known as cognition disorder. In various recent surveys, it is described that the deficiency of ω -3 Poly - unsaturated fatty acid (PUFA) effects on cognition. Clinical studies are performed to show the proof of therapeutic and clinical value of ω -3 poly -unsaturated fatty acid in neurodegenerative disease such as Alzheimer disease (AD). These disorders found in that people are aged or older and there is a requirement of treatment at an initial stage of the disorder. Thus, this is movement of study the effectiveness, safety and benefits of ω 3 polyunsaturated fatty acids in cognitive disorder by using recent studies [1]. The aim of the survey to improve cognitive performance and mood related disorders globally. This work is one of the comparative study of the mood related disorders specially cognition in community. Cognitive disorder is a major bipolar disorder because of inadequate quality of life and due to functional impairment. Previous study on that point was cited that the presentation of the field compared with controls [2].

Cognitive disorder creates problem related to functional impairment and alterations in mood disorder. Therefore, cognitive disorder is a major destination for the study of this subject [3]. Bipolar disorder impact on 1% to 3.8 % all over population. In case of major depressive disorder, it has ranged from 4.7% to 10.7% of the whole population. One of previous study shows the cognitive related problems in Brazil, they study this mood related disorders in patient and showed major impact of mood related disorders. They also collect the data connected to population suffering from bipolar disorder and cognitive impairment. In another written report they also judge the different forms of the disorder found in the subjective study in early stage and long term stage. Late stage illness, cognitive disorder shows the greater damage, cognitive performance as compared to control group [4]. Cognitive weakening is a significant parameter of psychiatric disorders such as bipolar conditions, cognition, depression and schizophrenia [5, 6]. Antipsychotic drugs used to treat the neurodegenerative disorders may offer the greatest improvement in cognitive behavior [7]. Spell, the efficiency of present medicines in the management of cognitive indications is quite bit controversial [8]. Therefore new medications required for management of the cognitive impairment and some surveys were executed with respect to this [9, 10]. Age related parameters of cognitive mapping is found in humans [11]. Actually, aging is the most important risk parameter for the deterioration of cognitive related disorders [12].

Cognition disorder is the major problem presently observed in elderly patients and the treatments available for this disorder is ineffective due to some interferences. In market there are several products are available related to the recognition enhancement in children's but very few or negligible products are there in the market for the elderly as well as adult patients. Therefore, it is broad scope for the formulation scientist to develop such products which will be modify the recognition within elderly as well as adult patients [13]

2. Role of ω -3 fatty acids in cognition and neurodegeneration

ω -3 fatty acid have been associated in life, which providing the strong healthy aging all over lifecycle. Recently, DHA and Eicosahexaenoic (EPA) constituents of ω -3 fatty acid obtained from the marine (fishes) associated source, which shows significant development in different neurodegenerative disorders [14, 15]. DHA and EPA are incorporated in various body functions making up cell membranes and also working as an important role in viscosity of the cell different membranes [16, 17]. DHA is an important factor of cell membranes and mostly obtained in eye retina and brain cell membranes [18]. It may really challenge to acquire sufficient consumption of DHA and EPA via food alone, even they are obtained from the water plants like marine creatures and algae. Another one shorter chain containing constituent of ω -3 fatty acid, alpha linolenic acid (ALA), is a noticeable element of our food, as it is set up in numerous land plants which are usually eaten by man, however it do not offer health aids observed with DHA and EPA [19]. While, it can be possible for the human body to transform ALA to DHA and EPA by using desaturase and elongase enzymes, but earlier reported research shows that just a small quantity of enzymes are synthesized in the body for this practice, which are not sufficient to conversion [20].

Involuntary, weight loss is the foremost problem with numerous patients with AD may face, the supplement containing DHA and EPA gives patients weight gain significantly in this case. According to recent studies, DHA and EPA may provide different functions with cognitive performance, weight management and prevention of soft type of AD. While, results obtained from the different fields concerning the disease caused, due to AD like cognitive dysfunction is mange promisingly by using the ω -3 fatty acids [21]. Patients having AD shown to be insufficient of DHA and EPA, by treatment with supplements of DHA+EPA is not only recovers the deficiency, but also improved the cognitive properties in patients with minor AD [19]. In aged populations, cognitive deficiency accompanying with dementias and AD has developed a considerable trouble. It's presently estimated that the roughly 35.6 million patients are surviving with dementia all over the earth [22]. Although, this disturbing statistic, it is predicted that postponing of disease treatment develops many patients with the same.

AD is primarily categorized by amnesia executive impairment and developments to global shortfalls that eventually contribute to total incompetence [23]. Recent surveys suggest that the higher consumption of ω -3 fatty acids is accompanied with a lesser rate of cognitive failure and may be defensive in contradiction of the approach of cognitive deficiency and neurological indisposition [24]. The ω -3 fatty acid management was accompanied with a small, but a

beneficial, important for instant attention, recall and processing velocity, persons with mild AD [25] ω -3 fatty acids have significant roles in the management and prevention of different human neurodegenerative diseases. Their protective properties of the brain later in life in contradiction of disorders like AD are unidentified but they are positively praiseworthy of study. Preclinical and epidemiological studies suggest that the ingesting of elongated chain ω -3 fatty acids may show the cognition weakening and avoid the advancement of mental health complaints such as AD. The correlation between ω -3 fatty acids and mental health disorder has been shown with lesser extent, of ω -3 fatty acids in the blood plasma of the patients suffering from the neurodegenerative diseases as associated with healthy people [26-28].

3. Origin of ω -3 fatty acids

The purposes of ω -3-Fatty acid is most focused to treat or to prevent the different neurodegenerative disorders. The effect of ω -3 fatty acids on cognitive function with aging, dementia & neurological disorder is appreciable. Quadragerian People (above 40 years) suffer from the several physiological dysfunction have been allocated ω -3-Fatty acid, have Major role in the campaign of the calcium ions in the cells, due to this calcium ions contraction & relaxation of the smooth muscles are taking home [29].

The ω -3 fatty acid contents different chemical components. It is mainly composed with main three different chemical constituents, namely, a) Alpha-linolenic acid (ALA), b) Eicosapentaenoic acid (EPA), c) Docosahexaenoic acid (DHA). Some selective food is the best sources for the ω -3 fatty acids, which should be provided to the body as a supplementary source to carry out the requirement of ω -3 fatty acid [30]. DHA and EPA are polyunsaturated fatty acids, which are found more often than not in marine sources as good as in algae. Together DHA and EPA are both significant fatty acids that get into the body via ingestion of fortification and marine products. Many studies disclose that this fatty acids gives significant function for maintaining a healthy body [31]. Increasing requirement of DHA and EPA enclosing fish oil source is knocking burden on fish species. Many fisheries delivers fishes for the human ingestions, therefore fishes for the purpose of preparation in medicine makes shortage. Therefore, some approaches have been initiated such as plant based ω -3 fatty acid rich diet. Furthermore, algae oils, plants based oils, different nuts and seeds based oils, legumes, veggies, grains and different fruits [32].

4. Mechanism of action of ω -3 Fatty acid in neurodegenerative disorders

The neurodegenerative disorder noticeable by cognitive and developing diminishing due to impaired learning capability that expressively inhibits with communal and job-related functioning. This sort of behavioral modifications abridged stages of brain imitative neurotropic factor (BDNF), synapsin I, moreover camp approachable element-binding protein (CREB). It is recognized that BDNF enables synaptic communication and learning capability by moderating synapsin I and CREB. In this situation, one of the foremost counteracting diet sources is ω -3

polyunsaturated fatty acids (i.e. DHA) in the head, has exposed to be necessary for normal neurological growth, maintenance of learning and remembering, and neuronal plasticity furthermore control signal transduction and gene expression, and safeguard neurons from death and can decrease cognitive collapse throughout aging and Alzheimer's disease. Therefore, it is conceivable that select nutritional constituents ingested at the suitable time can be used to regularized levels of BDNF and related synapsin I and CREB, decreased oxidative damage, and counteracted learning disability [33, 34].

ω -3 fatty acid has also been discovered to decrease vascular risk, inflammation and oxidative damage. Available clinical studies comparing the occurrence of Alzheimer's disease among elderly individuals with different levels of dietary ω -3 fatty acid consumption, propose that risk of AD is meaningfully reduced amongst those with larger levels of fish and ω -3 fatty acid ingestion [35]. Unintentional condition and some social traumatic situation develop brain injury that time brings about a state of susceptibility that decreases the brain capability to possibility with secondary invectives. The silent information regulator-2 (SIR-2) has been linked with preserving genomic constancy and cellular homeostasis underneath exciting condition. Aiguo W. U. and et al recently reported the novel evidence presenting that mild traumatic brain injury decreases the manifestation of SIR-2 in the hippocampus, in amount to augmented levels of protein oxidation. To boot, he demonstrates that dietary supplementation of ω -3 fatty acids that improves protein oxidation was effective to reverse the reduction of SIR-2 level in wounded rats. Supplementary, he was found that traumatic brain injury reduced ubiquitous mitochondrial creatine kinase (uMtCK), an enzyme implicated in the energetic regulation of Ca-2 pumps and in the maintenance of Ca-2 homeostasis. ω -3 fatty acid supplements normalized the levels of attack after lesion [34]. Mechanism of action of ω -3 fatty acid with neurodegenerative disorders is presented in image 2.

5. Combination approach of ω -3-Fatty acid with other agents in neurodegenerative disfunctioning

ω -3-Fatty acid is chemically active element which provides the action in different type of the diseases and disorders, with combination or singly. Different applications are discussed below, regarding the ω constituents DHA and EPA. ω -3 fatty acids having a complementary role in energy metabolism and brain function and that optimum retention of cognitive function, such as ketogenic substrate, weak precursor to ω 3 PUFA, Stimulation of fatty acid β -oxidation and ketogenesis, neurotransmission, learning and memory and Brain glucose uptake etc. [36]. The different Physiological functions have been attributed to ω -3 FA, including: 1) Movement of calcium and other substances into and out of cells. 2) Relaxation and contraction of muscular tissues. 3) Regulation of clotting and of secretion of substances that include digestive enzymes and hormones. 4) Control of fertility, cell division, and development [37].

ω -3 fatty acids are aids to inhibit and treat anxiety and depression with EPA, which is the show's most general antidepressant activity[38]. DHA is a constituent of the ω - 3 fatty acid, which is a most important structural part of eye retinas. It plays a significant role in the inhibition of muscular degeneration, further causes blindness and vision impairment [39, 40] Ingesting of sufficient amount of ω -3 fatty acid with dietary supplements throughout the gestation period is helpful for fetus developers [41] People by means of mental disorder often cause diminished

blood levels of ω 3 fats. In this example it increases the ω -3 fatty acids to improve their symptoms. [42] ω -3 fatty acids help to inhibit the age-related mental disorder and cognition disorder. [43] ω -3 intake may reduce the chances of the risk related to the cancer tumors in brain, and other organs of the human torso. [44] Intake of DHA, which nothing but a constituent of ω -3 fatty acids, may extend the time span and quality of the rest. [45] ω -3 fatty acid serves as a large source of the antioxidants, which provides glow on face, skin and improves your recognition power [46].

6. Future potential of ω -3 fatty acids in cognition

Presently, due to the augmented consciousness of the health paybacks of DHA and EPA, the demand of fish oil increased and fish population day by day decreased. However, recommendations to improve in ω -3 fatty acid ingestion will deliberate health threats. During the cooking of the difference ω containing foods, loses the fatty acid content during heating and may create the harmful free radicals, which should be looked at. Alternatives for the ω -3 fatty acid such as microalgae, which is a deep source of fatty acids, but the output cost of the mirage is quiet high. Plant based fatty acids similar of marine oil leftovers a big dare, since modifying the composition of ω -3 fatty acids in plant seeds to reach a fish oil alternative is the most important target [47]. Genetic engineering encoding with DHA and EPA biosynthetic pathways with diet grade bacteria's like yeast and lactic acid microbes may be used as maintainable and cost effective substitute source for the fishes and still effective modern technologies must be applied for that. Nevertheless, transesterification and interesterification will leftovers capable techniques of generating ω -3 fatty acids. Meanwhile, ω -3 fatty acids may attention with extra food constituents with the food environment, the impact of like interaction on the nourishing effect of ω -3 fatty acids for further probe [48-50].

7. Conclusion

The shock of the nutrition has the prospective to significant effect on physical function and body intake. Special care has been taken on ω -3 fatty acids, which are obtained from the marine source as good as terrestrial features. This containing DHA and EPA are responsible for the many signaling, various cellular functioning, cellular fluidity, cognition maintenance and enhancement. Also contains the different organizations related to the cognition such as nervous systems, glucose regulation, inflammatory progressions which may be right away or indirectly effects on the cognitive system. Animal based, cells based, fruits based, oils based, seeds based and plant passed, like different types based ω -3 fatty acid sources are covered. The ω -3 fatty acids seems to be among the utmost important supplements for the tremendous diversity of the worlds. Additionally, ω -3 fatty acid dietary intake should be increased to overcome the deficiency of the ω in the body to maintain cognition. Likewise, ω -3 fatty acids maintained their own properties after packaging with healthful food other than fish. Nutritional approaches and supplements like ω -3 fatty acids may result in improved regaining, reduced risk of AD, optimal training gain and increased levels of

competition enactment. This backings the view about DHA and EPA, which may increase the performance of the in recognition and other associated actions. This receives the potential benefits regarding the neurodegenerative disorders.

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