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Effects of omega 3 polyunsaturated fatty acids eicosapentaenoic and docosahexaenoic acids in the Alzheimer's disease and depression treatment

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Abstract
Omega 3 polyunsaturated fatty acids particularly EPA and DHA can prevent the diseases of brain related disorders at clinical as well as in experimental studies. These polyunsaturated fatty acids improve the brain health by the modulation of apoptotic pathways. EPA and DHA proved to be beneficial in Alzheimer's by increasing the regulation of gene expression related with neurotransmission. It is also still unknown that whether EPA acts directly or as a precursor of DHA. Here we describe the role of EPA and DHA in the treatment of Alzheimer's disease and depression as well as their beneficial role in the diabetes, inflammation, hearth heath and neurons related processes in the brain. The further analysis will show the beneficial and protective role of EPA and DHA that how they can combat and prevent these diseases. The omega 3 polyunsaturated fatty acids EPA and DHA have various properties of neuroprotection due to which these fatty acids proved to be beneficial and effective in the treatment of Alzheimer's disease and depression. The patients of Alzheimer's disease have lower levels of DHA in their brain; it can be reduced by the regular consumption of DHA supplementation. This review analyzes the hypothesis of EPA and DHA as effective components of PUFA in the treatment of Alzheimer's disease and depression. The consumption of long chain omega 3 polyunsaturated fatty acids EPA and DHA found in the fish oils show the beneficial effects on the neuropsychiatric diseases.
Keywords: Alzheimer's, depression, EPA, DHA

Introduction

Omega 3 polyunsaturated fatty acids are defined as a fatty acids consisting of long chains and are found in marine as well as the plant sources that includes fish, shrimp as well as more abundantly in the cold water (Friedman & Moe, 2006). Omega 3 fatty acids are one of the polyunsaturated fatty acids that are known to be correlated with the diseases of brain such as Alzheimer's disease (Zivkovic *et al*., 2011). The eicosapentaenoic and docosahexaenoic acids are known to attenuate the atherosclerosis (De Caterina *et al*., 2004). Omega 3 polyunsaturated fatty acids EPA and DHA are also found to reduce the risk of brain diseases mainly neurodegenerative e.g. includes the reduced risk of Alzheimer's disease (Schaefer *et al*., 2006).

The polyunsaturated omega 3 fatty acids mainly the eicosapentaenoic and docosahexaenoic acids has been found beneficial in the prevention of cardiovascular disease due to their different in the cardiac health as well as they also possess the properties of anti-inflammation (Kotwal *et al*., 2012). But a recent study also concluded that EPA and DHA can also treat the certain types of mental illnesses including the depressive disorders (Grosso *et al*., 2014). It is also proposed that some of the depressive diseases such as depression have same pathological mechanisms as of the cardiovascular disease. Some of the clinical studies also shown that concentration of the omega 3 fatty acids is lower in the red blood cells membranes in those patients who are depressed (Rees *et al*., 20019; Schins *et al*., 2007). Although the combination of all these studies has revealed that there is a correlation between the intake of omega 3 fatty acids

and depression. Furthermore, it was concluded that the treatment of depression depends mainly on the administration of the eicosapentaenoic acid rather than docosahexaenoic acid as well as the quality of study and the depression severity (Bloch *et al*., 2012). The number of studies on Alzheimer's disease and dementia were conducted and has shown that the supplementation of EPA and DHA has shown positive effects in number of animals particularly in the patients who were elder (Fernandes *et al*., 2015). A number of long chain omega 3 fatty acids particularly the EPA and DHA have shown positive effects in the aging brain (Gomez-Pinilla 2008; Fotuhi *et al*., 2009; Hoojimans *et al*., 2012). A number of experiments were conducted on animals and show that supplementation of the omega 3 PUFA's (LC-n3-FA) uptakes the proteins of the synaptic membrane mainly embedded in the plasticity of synaptic membrane (Cansev and Wurtman, 2007). Various studies on the human beings shown beneficial effects of omega 3 polyunsaturated fatty acids on the cognitive functioning (Kalminjh *et al*., 2004). The EPA and DHA have also been found to have cardio protective effects (Egert *et al*., 2016).

In the current era it has been proposed that 10% of the world's population is affected from the depression (Song *et al*., 2016). The depression is defined as the disorder of brain in which a person loses the normal life pleasure, disturbance in sleep, poor appetite, fatigue in body and the ability to concentrate and thinking is decreased or lessen (Song *et al*., 2016). It was proposed that these symptoms of the depression disorder can lead to the cases of suicide as well as become chronic with the passage of time (Kupfer *et al*., 2012; Soleimani *et al*., 2011). The dysfunctional axis of the hypothalamic pituitary adrenal gland may lead to the illness, along with stress that may be chronic or acute as a triggering condition. It was also found that prolonged elevation of the hormones of hypothalamic pituitary adrenal gland as glucocorticoids can result in the impairments of the cognitive, atrophy condition and the reduction of neurogenesis mainly in the hippocampus part of the brain (Leonard *et al*., 2007; Anacker *et al*., 2013).

Alzheimer's disease is another type of brain disorder that is defined as a neurodegenerative disease mainly progressive, the result of this brain disease is dementia (defined as a short term memory loss, language, self-care and motivation deficits (DSM-5, 2013). The main root cause that leads to the occurrence of the cognitive deficits particularly memory is the loss of neurons that are responsible for releasing the acetylcholine, cerebral cortex innervation and some other structures along with hippocampus. A study also show that the main cause for the initiation of the Alzheimer's disease is the amyloid plaques abnormal accumulation specifically in the neurofibrillary tangles as well as the milieu particularly extracellular. The composition of these amyloid plaques includes the peptides of amyloid Beta, while the neurofibrillary tangles are composed of protein known as tau that is hyper phosphorylated (Schliebs *et al*., 2011; Zhang *et al*., 2011). Alzheimer's disease is also known to affect the 35 million population of the whole world and is also considered to be as a public health problem (Fernandes *et al*., 2015). The dietary intake of 1 to 2 servings/week of fish that should be supplemented with the oil of fish as well as the intake of foods which are fortified can add eicosapentaenoic and docosahexaenoic acids in a person's diet (Bellows *et al*., 2015). The omega 3 polyunsaturated fatty acids EPA and DHA are found in the fish as such or in the fish oils (Young and Julie, 2005). The DHA is mainly found in the fish and the seafood. The most abundant source of DHA is fatty fish, tuna and mackerel (USDA, 2005). The EPA and DHA omega 3 polyunsaturated fatty acids are mainly derived from natural product of health particularly known as fish oil (Natural Health Product Fish Oil, 2013).

Health benefits

The omega 3 fatty acids are well known for health benefits. The consumption of EPA and DHA is suggested by many authorities as they can treat the many chronic diseases (Russel & Corinna, 2012). The following are some of the health benefits of omega 3 fatty acids:

Heart health

The omega 3 fatty acids benefits in the heart disease are well known. The omega 3 fatty acids are protects the human heart in such a way that they decrease the process of arrhythmias (Bellows *et al*., 2015). Furthermore, they can protect the heart by lowering the formation of blood clot, blood pressure and inflammation. It is also known that consumption of omega 3 fatty acids can also better the artery cells functions (Bellows *et al*., 2015). The dietary guidelines of United States 2010 concluded that if 2 servings of the seafood are consumed per day, they provide almost a 250 mg/day of the omega 3 fatty acids mainly long chain. This consumption of omega 3 fatty acids per day can help reduce the cardiac

death particularly from the coronary heart disease and also help to reduce the cases of death that is sudden in persons present with or without the heart disease (Bellows *et al*., 2015).

Inflammation

The consumption of omega 3 fatty acids in the adequate amounts provides the functions of anti-inflammatory mainly in vivo (Young & Julie, 2005). These anti-inflammatory effects can be achieved when the production of eicosanoids and cytokines is to be modified. It was also shown that the Interleukin factor 1 is decreased when the feeding of fish oil is provided by reducing the risk of inflammation (Hardardottir & Kinsella, 1991). Furthermore, it is also proved and studied that if the eicosapentaenoic acid consumption amount in the diet is increased, it leads to the certain shift of the (LTB4) that is inflammatory leukotriene of the eicosanoid and also leads to the production of leukotriene anti-inflammatory B5, thereby response of the inflammation is attenuated (Youdim *et al*., 2000). So it is concluded that the omega 3 polyunsaturated fatty acids influence on the physiological process of the inflammation and diseases of the neuropsychiatric is very important (Young & Julie, 2005). It is also known that inflammatory response over activity may be cause of the mood disorders that are mainly concerned with the activation of the immune system (Young & Julie, 2005).

Rheumatoid arthritis

The rheumatoid arthritis is such a disease in which the beneficial and therapeutic effects of omega 3 polyunsaturated fatty acids are known, as it is known that the immune system modulation can reduce the effects of compounds which are inflammatory (Darlington & Stone, 2001). A study on clinical trials was conducted that included the 395 patients divided into control and intervention groups the reduction in the tenderness of the joints was seen and also the morning stiffness was also improved (Fortin *et al*., 1995).

Kidney disease

A variety of studies were conducted in animals on trial basis. The result showed that omega 3 fatty acids consumption can reduce or slow down the kidney failure, reduces the blood pressure and also modulates the hypertension various side effects (Imig *et al*., 2005; Zhao *et al*., 2004).This study further needs to the research for omega 3 fatty acids role in the improvement of kidney disease (Angela *et al*., 2011).

Diabetes

Diabetes is such a disease that leads to increase in the plasma glucose along with low density lipoproteins (LDL) and triglycerides (Gogus & Chris, 2009). It was also studied that diabetes also increases the low density lipoproteins oxidative susceptibility, increase the levels of nitrous oxide along with increasing the cytokines release and synthesis (Gogus & Chris, 2009). A research was conducted that in which rats suffering from diabetes were treated with the supplementation of omega 3 polyunsaturated fatty acids, it shows that the level of plasma triglyceride with low density lipoproteins was decreased as well as the synthesis of cytokines was also noted (El-seweidy *et al*., 2002). The studies of scientists reported that the consumption of omega 3 polyunsaturated fatty acids may have a beneficial role in the diabetes treatment as they are available to the sugar levels of blood lower in number and also lessen the hazards that are related with the inflammation (El-seweidy *et al*., 2002; Gavia *et al*., 2003). Omega 3 polyunsaturated fatty acids are also used to treat the diseases of gastrointestinal as they decrease the aggregation of platelets (Levy & Herzberg, 1996). However the treatment effect with the omega 3 polyunsaturated fatty acids depends upon the type of fatty acid used (Gogus & Chris, 2009).

EPA and DHA synthesis

The omega 3 polyunsaturated fatty acids eicosapentaenoic and docosahexaenoic acids are converted from the omega 3 fatty acid alpha linolenic acid progenitor C18 (Song *et al*., 2016). The DHA and EPA both of these omega 3 fatty acids are synthesized from the alpha linolenic acid that is the precursor of omega 3 fatty acids (Ruxton *et* al., 2004). This conversion of EPA and DHA is carried out through two processes; one is known to be elongation and the other one is known as a desaturation. The metabolism of eicosapentaenoic acid is brought about through the stearidonic acid derivatives and by the alanine. The delta 5 and delta 6 desaturase are involved in the metabolism of eicosapentaenoic acid (Song *et al*., 2016). The synthesis of docosahexaenoic acid is carried out through the Beta oxidation that removes the chain of carbon and then DHA is again transported into endoplasmic reticulum by the process of esterification in the membrane (Song *et al*., 2016). While in studies of human with the help of tracer of isotope it is noticed that the

conversion of alanine is lessen towards the synthesis of eicosapentaenoic, eicosapentaenoic and docosahexaenoic acids (Barceló, 2009; Burdge & Wootton, 2002; Pawlosky *et al*., 2001). In this whole process the rate reducing compound is the delta 6 desaturase as it metabolizes the alpha linolenic acid. The delta 6 desaturase is further occupied by the substrates two in number that elaborate the process of eicosapentaenoic and docosahexaenoic acids accumulation when the intake of alanine is abundant mainly dietary (de *et al*., 2004; Fu, 2000). The metabolism of alanine may also be handled out by the Beta oxidation as well as the reaction which is elongase (Sprecher, 2000; Gregory *et al*., 2011; Gregory *et al*., 2014). Due to the synthesis of docosahexaenoic acid mainly marginal, in the bodies of human beings the accumulation of the docosahexaenoic acid primarily depends upon the DHA consumed from the dietary source (Cunnane *et al*., 2000). To meet the nutritional requirements of the docosahexaenoic acid different new techniques have been developed. For example the metabolism of eicosapentaenoic and docosahexaenoic acids can be increased by the mammalian cells that are overexpressing the delta 5 and delta 6 desaturases (Song *et al*., 2016). It was also found and noticed that when *Siganus canaliculatus* was expressed particularly of the delta 4 desaturase, the docosapentaenoic acid is converted very smoothly directly to the docosahexaenoic acids. This docosahexaenoic acid may be used for the generation of transgenic livestock, if the products used are rich sources of the (DHA) docosahexaenoic acids (Zhu *et al*., 2014).

Functions

There are various functions of the omega 3 fatty acids. The functions of the omega 3 polyunsaturated fatty acids at a cellular level are known to be complex. The effects of omega 3 PUFA include the following: 1) the function as well as structure of the membranes of neurons and rafts of lipid is modulated by the omega 3 fatty acids also in proteins that are incorporated including the signaling proteins (Dirk & Song, 2012). 2) They act as ligands for the transcription factors of the genes that are known to play a role in the variety of processes such as metabolism of fatty acids, oxidative stress as well as the process of inflammation. 3) They also play a vital role in synaptogenesis and the process of differentiation (Dirk & Song, 2012). 4) Omega 3 polyunsaturated fatty acids are also know to act as a precursors for the lipid mediators biosynthesis that function as a key in many cells regulation as well as responses of the tissues (Dirk & Song, 2012). The different aspects of the process of inflammation are also regulated by the omega 3 PUFA. 5) The intake of polyunsaturated fatty acids from the diet and ratio of the omega 3 and omega 6 polyunsaturated fatty acids ingested can affect the function of polyunsaturated fatty acids which in turn can affect the cellular functions (Calder, 2011). The omega 3 fatty acids mainly eicosapentaenoic and docosahexaenoic acids are found to play their role in the pain of arthritis disease and other symptoms. The EPA and DHA are also known to reduce the stiffness of joints (Goldberg & Katz, 2007). 6) The omega 3 polyunsaturated fatty acids also play a pivotal role in the disease of cystic fibrosis (Ruxton *et al*., 2004). 7) The replenishment of omega 3 polyunsaturated fatty acids from diet can compensate with the neurodegenerative changes (Yehuda *et al*., 2002). 8) The long chain fatty acids are also known to take a part in the membranes of neurons by modulating those (Dirk & Song, 2012). The most important functions of the eicosapentaenoic and docosahexaenoic acids include the development of the brain health and health of heart (Bellows *et al*., 2015). 9) The consumption of omega 3 fatty acids in the latest research also concluded that they play a pivotal role in the diseases such as lupus as well as the diseases of cancer (Bellows *et al*., 2015). 10) The omega 3 polyunsaturated fatty acids mainly the docosahexaenoic acid (DHA) is known to be important for the development of central nervous system of the infants as well as in the growth of CNS, it was also found that DHA is considered as a major part of the neural tissue particularly of the fetus therefore is best known for its functions in the neurotransmitters (Bellows *et al*., 2015).

EPA and DHA in Alzheimer's disease

A neurodegenerative disease that is known to be progressive is referred to as an Alzheimer's disease (Song *et* al., 2016). Alzheimer's disease is defined as a pathological disease of protein. There is various numbers of factors that contribute in the Alzheimer's disease. The number of genetic as well as the environmental factors is the major causes (Thomas *et al*., 2015). The risk of developing of Alzheimer's disease increases with aging. The genetic factors are known to be a root cause for this disease. This disease is known to be caused when the mutation in the genes occur particularly those which are encoding the precursors of the amyloid protein; also the presenilin contributes to the occurrence of Alzheimer's disease. Both of these have the linkage with the metabolism of Beta amyloid (Blennow *et al*., 2006). Alzheimer's disease is caused by the alterations in the cognitive functions, changes in behavior and loss of memory (Thomas *et al*., 2015).

The development of the plaques of the amyloid activates the cells mainly glial that leads to the augmentation of the inflammation in the brain (Thomas *et al*., 2015). Eicosapentaenoic and docosahexaenoic acids are known as the long chain omega 3 fatty acids. They are known to present in the oils of fish as well as in the fishes itself (Bellows *et al*., 2015). Out of the omega 3 fatty acids EPA and DHA have the beneficial effects, increasing the intake pf EPA and DHA in the diet can significantly contributes in the health. EPA and DHA are known to have significant effects in the treatment of brain and neurodegenerative disorders, one of them are Alzheimer's disease (Song *et al*., 2016). According to the recent research it is found that if lower DHA is taken in the diet in can contribute towards the Alzheimer's disease as it is consumed in a lower amount (Bellows *et al*., 2015). Recent studies were conducted that sowed the effects of EPA and DHA in Alzheimer's disease. These studies include the patients of both the genders males as well as females between the ages of 72.6-85 years old. The patients were diagnosed for the treatment of mild as well as moderate Alzheimer's disease (Folstein *et al*., 1995). The tests that were used for the assessment were scales of clinical dementia (Morris, 1997), scale of the Alzheimer's disease assessment (Weyer *et al*., 1997) and mini mental examination scale (Folstein *et al*., 1995). The pills of both EPA and DHA were provided to the within the day time, along with doses of 430 and 1,100mg per day of DHA and 975mg per day of EPA. The duration of this study was 6-18 months particularly. These studies concluded that several changes were found in the cognitive performance using the cognitive domain scores (Fernandes *et al*., 2015). The various researchers found the beneficial and positive effects in the elder patients by the supplementation of both EPA and DHA, within the condition of mild to moderate (Freund *et* al., 2006; Quinn *et al*., 2010; Shinto *et al*., 2014). The patients within a memory loss only (Terano *et al*., 1999), very mild Alzheimer's disease (Freund *et al*., 2006) and negative APOEε4 genotype (Quinn *et al*., 2010) states the improvement on the test cognitive scores after the EPA and DHA supplementation (Fernandes *et al*. 2015). The result of these studies concluded that the patients who healthier elders they show a better performance as compared to others when the supplementation of eicosapentaenoic and docosahexaenoic acids was provided (Johnson *et al*., 2008) and it was also found that these people when supplemented the decline in the cognitive functioning improved particularly in patients of dementia and Alzheimer's disease (Sinn *et al*., 2012). Furthermore, some other various studies were also conducted showing the effects of eicosapentaenoic and docosahexaenoic acids in the Alzheimer's disease. The patients of the Alzheimer's disease and decline in cognitive functioning are found to be having the minute plasma concentrations of the antioxidants, one of them is carotenoids (Craft *et al*., 2004; Wang *et al*., 2008). The carotenoid that is found to be predominant in the brain of humans is lutein (Johnson *et al.,* 2013; Viswanathan *et al*., 2014). So if lutein is provided along with the docosahexaenoic acid it can show the beneficial results in the patients of Alzheimer's disease (Johnson *et al*., 2008). It was also noticed that the folic acid can increase the plasma concentration of both eicosapentaenoic and docosahexaenoic acids (Das, 2008). So if their concentration is well they can perform better in Alzheimer's disease and other cognitive functions. In 2006 Freund-Levi and colleagues who conducted the study on 174 patients to see the effects of omega 3 fatty acids in Alzheimer's disease. These scientists provided the 1.72g of docosahexaenoic and 600mg per day of eicosapentaenoic acids supplementation, but no significant results were found (Freund *et al*., 2006). But significant results were found in the sample size of 27 patients who were diagnosed for the mild Alzheimer's disease form. A significant amount reduction was found in the cognitive functioning that was declining compared to the above study (Freund *et al*., 2006). However, the EPA and DHA supplementation given in combination can is a better option to treat the cognitive decline instead of giving a single fatty acid (Song *et al*., 2016). The recent studies also found that EPA and DHA supplementation provided in combination shows the better function in the cognitive impairment in the models of animals who were suffering from the Alzheimer's disease (Song *et al*., 2016).

EPA and DHA in Depression

The depression is such a type of brain disease which affects approximately 10% of the world's population. In this disease the patient loses the interest in pleasure, a cycle of improper sleep, fatigue, capacity of thinking and the ability to pay concentration is diminished or lowered (Song *et al*., 2016). Low levels of the polyunsaturated omega 3 fatty acids are known to be the cause of suicide and depression as well as the cause of heart diseases, more common disease that can occur is (CVD) cardiovascular disease (Elizabeth *et al*., 2013). The EPA is found to be cause an increase in the production of the DHA in brain. So it was noticed that eicosapentaenoic acid is known to be the precursor for the production of docosahexaenoic acid in brain (Elizabeth *et al*., 2013). It was also further investigated that if conversion of

eicosapentaenoic is limited or decreased to the docosahexaenoic acid it may lead to the cause and occurrence of the depression. A study was conducted showing the positive effects of eicosapentaenoic acid in the rats. In this study it was concluded that the consumption of ethyl eicosapentaenoic acid can lead to the increase of glial as well as the neuronal EPA content in the rats (Kawashima *et al*., 2009). A study conducted in 2010 including 15 different trials and 916 patients (Elizabeth *et al*., 2013). The supplementation of eicosapentaenoic acid greater than or equal to 60 % showed the beneficial and protective effects on the depression patients (Elizabeth *et al*., 2013). This supplementation of eicosapentaenoic acid in the dosage of 200 to 2200 mg in excess of docosahexaenoic acid was to be beneficial against the depression (Elizabeth *et al*., 2013). It was also cleared in this study that consuming the eicosapentaenoic acid for 9 months leads to an increase in the phosphodiesters that are considered to be the initiator of the phospholipids as well as beneficial and effective in the treatment of major depression (Puri *et al*., 2001). The study above discussed that in case of acute depression if 60% of the eicosapentaenoic acid up to 2000mg along with excessive docosahexaenoic acid proved to be sufficient and plays a protective as well as effective role in the brain disorder known as depression (Elizabeth *et al*., 2013). According to the agreement of the Ross *et al*. and Martins, the study conducted of EPA supplementation proposed that eicosapentaenoic acid is considered to be effective component of polyunsaturated fatty acids in the treatment of depression (Ross *et al*., 2007; Martins, 2009). The supplementation of eicosapentaenoic acid for 9 months increases the proportion of cerebral phosphomonoesters in case of depression disorder (Puri *et al*., 2001). The various studies regarding the supplementation of DHA were also conducted. One of the study showed that 36 patients were taken who were suffering from the disease of depression. The ages of these patients ranges between 18 to 65 years (Lauren *et al*., 2003). All of these patients were provided with the supplementation of docosahexaenoic acid. The dose of DHA provided to these patients was 2g/day and the duration of this study was of 6 weeks regarded as a placebo study. The two different rating scales for this double blind placebo were adopted. One of the scales was rating scale of Montgomery Asberg depression, this scale was scored as the 12 or greater (Montgomery and Asberg, 1979). The second rating for this placebo study included the rating scale of 28 item Hamilton depression scale, it was scores as 17 or greater. It was also recommended that the intake of fish should be not more than one serving per week (Lauren *et al*., 2003). The Montgomery Asberg rating scale was regarded as a measure and the response of this rating scale was 50 percent or more than this starting from the line of base to the point of ending. The patients start receiving the 2g/day supplementation the DHA for 6 weeks. The various assessments regarded as a follow up were taken after the patients received the recommended dose of the docosahexaenoic acid (Lauren *et al*., 2003). Out of the 36 patients 35 of them were examined and evaluated. The 18 patients suffering from depression received the doses or supplementation of docosahexaenoic acid and 17 of these patients had taken the placebo. The results that were concluded from this study shown that the patients who were taking the supplementation of the docosahexaenoic acid has the rates of response as 27.8 percent. On the other hand the patients suffering from the same disorder depression on the placebo group were showing the response rates of the 23.5 percent (Lauren *et al*., 2003). The difference or the variation between these two different groups was showing that both of them did not reach the line of the significance statistically provided. However due to the deficiency of various therapeutic responses in these studies, it was concluded that the supplementation or dosage of the omega 3 fatty acids (mainly eicosapentaenoic and docosahexaenoic acids) in the disorders of bipolar treatment is very much different from the treatment of the unipolar depressive disorder (Lauren *et al*., 2003). Therefore the overall result concluded from these studies was that various aspects are needed to study and investigate the potential as well as the beneficial role of omega 3 fatty acids in the treatment of the different disorders related to the depression (Lauren *et al*., 2003). However there is a need despite these facts to study the omega 3 polyunsaturated fatty acids in the treatment of depressive disorders (Lauren *et al*., 2003).

Conclusion

The consumption of omega 3 polyunsaturated fatty acids EPA and DHA in the treatment of Alzheimer's disease as well as in depression is effective. The intake of omega 3 polyunsaturated fatty acids EPA and DHA should be recommended for patients suffering from various brain diseases including depression and Alzheimer's disease. However the better understanding and future perspectives of EPA and DHA can help a lot in improving the disease state related to the condition of the patient. There are number of factors that contribute to the EPA and DHA effects including saturation degree, length impactness as well as the other factors like transcriptional factors. I suggest that omega 3

polyunsaturated fatty acids EPA and DHA regular consumption of 2 servings per week can be effective and beneficial in the treatment of brain disorders mainly Alzheimer's diseases and depression. The main beneficial effect of consuming EPA and DHA through diet can help brain to modulate the signaling pathways that can mediate the process of inflammation. If 200-2200 mg supplementation of EPA were protective and beneficial in the treatment of early depression. The intake of 150-975 mg per day has been shown to impart the beneficial effects in the treatment of Alzheimer's disease. The future aspects should perform a various studies to suggest the EPA and DHA alone or separately in the treatment of Alzheimer's disease and depression. It is also concluded from this review that the regular consumption of omega 3 polyunsaturated fatty acids eicosapentaenoic, docosahexaenoic as well as the folic acid are beneficial in improving the functions of cognition and proves significant in the treatment of Alzheimer's disease, depression, short term memory loss. Furthermore the dietary intake of EPA and DHA also shows a protective as well as effective role in the treatment of brain diseases like Alzheimer's disease and depression as these polyunsaturated fatty acids enhances the levels of acetylcholine that is released from brain. The intake of EPA and DHA also show the significant effects in the treatment of perinatal depression and provides the protection against short term memory loss that particularly occurs in the elderly population. The EPA and DHA also play a beneficial role in the development of infant brain. The DHA consumption is associated with the normal functions of brain and the prevalence of dementia, depression as well as the Alzheimer's disease is particularly related with the lower intake of EPA, DHA. The regular consumption of EPA and DHA fatty acids in daily diet can help a lot in the treatment of Alzheimer' disease and depression.

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