Seafood Consumption Can Prevent Alzheimer's Disease

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Key points: *Seafood consumption (e.g. marine fish) can prevent Alzheimer's disease (AD) by promoting stronger neurons (nerve cells) in the brain's gray matter. It further improves our cognitive function. Marine fish are a good source of fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) vital for human health. Cold water fish such as halibut, mackerel, anchovy, sardine, salmon, and tuna are enriched in EPA and DHA. Fish such as loitta, hilsa from the Bay of Bengal region have also high contents of both EPA and DHA.*

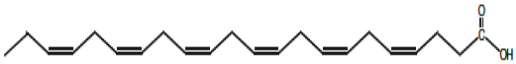
Alzheimer's disease (AD) is a progressive neurologic disease of the brain that leads to the irreversible loss of neurons and dementia (loss of intellectual abilities). There are currently about 18 million people worldwide with AD which is projected to reach 34 million by 2025. At present, more than 50% of people with AD live in developing countries. The prevalence of dementia is low or nil at the younger age but can occur at the age 40 but increases exponentially at the later age[1]. As many as 5.1 million Americans may have Alzheimer's disease. Alzheimer's disease is an incurable, progressive brain disease that slowly destroys memory and cognitive skills (basic metal abilities to think study and learn). It was first described by German psychiatrist and neuropathologist Alois Alzheimer in 1906 and was named after him.

Figure 1: *Seafood such as marine fish contains n-3 fatty acids or omega (ω)- 3 fatty acids such as Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA).*

An article published in the British Journal of Medicine in 2002 reveal that consuming seafood (e.g. marine fish; Figure 1) at least once a week can have a significantly lower risk of developing age-related dementia or AD[2]. Further and a very recent study (December 2011) found that people who eat baked or broiled fish on a weekly basis can improve their brain health and thereby reducing their risk of developing mild cognitive impairment (MCI) and AD (according to a study presented at the annual meeting of the Radiological Society of North America by Professor Cyrus Raji, MD, Ph.D of University of Pittsburgh School of Medicine[3, 4]). According to this study, consumption of fish promotes stronger neurons in the brain's gray matter (major component of central nervous system) by making them larger and healthier," Many other studies also found improved cognitive function of persons consuming a diet rich in EPA and DHA such as fish oils[5,6,7]. Regular fish consumption had also substantially reduced risk of developing Alzheimer's disease[8].

The positive links between seafood consumption and reduction of AD is thought to be associated with marine long chain of *n*-3/or omega 3 unsaturated fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) present in seafood such as in marine fish[9, 10] (see Figure 2) *(Note: Omega-3 fatty acids are a specific type of unsaturated fat that the human body cannot manufacture on its own).* It is believed that high omega 3 fatty acids found in fish are beneficial in correcting high levels of brain omega 6 fatty acids in humans thus reducing the potential of damage to the brain[10].

Eicosapentaenoic acid (EPA)
(20:5, n-3; EPA) (5 double bonds and 20 carbon chain); Oily fish or fish oil such as cod liver, herring, mackerel, salmon, menhaden and sardine have higher EPA.



Docosahexaenoic acid (DHA)
(*22:6, n-3; DHA) (6 double bonds and 22 carbon chain). Cold-water oceanic fish such as salmon and fish oils are rich in DHA*

Figure 2: *Chemical structures of EPA and DHA[11].*

Fatty marine cold water fish (e.g. halibut, anchovy, sardine, salmon, mackerel, and tuna; Table 1 and Figure 3) are enriched in EPA and DHA (Table 1)[12,13]. Fish such as loitta, hilsa (Figure 1) from the Bay of Bengal region have also high contents of EPA and DHA (Table 2)[14,15,16]. In general, fish oils have varying levels of EPA and DHA depending on species, season, and area of catching, age and gender etc[12]. Usually wild fish have more *n*-3 fatty acids in their fat[12,13]. Since human body cannot not synthesized EPA and DHA, therefore it must be obtained from other dietary sources such as marine fish.

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Though marine fish could be a good source of EPA and DHA, however, some spices of fish may contain significant levels of environmental contaminants (e.g. mercury, PCBs, dioxins, pesticides). Therefore, regulators in the developed countries (e.g. Food Standards Australia and New Zealand (FSANZ), and US Food and Drug Administration)) regularly monitor to ensure that seafood to be consumed by humans is safe and within the recommended seafood safety guideline values[18]. "Fish oil capsules" is an alternative source of EPA and DHA where environmental contaminants (e.g. Hg^{2+}, PCBs, and DDT) are removed as a procedure of purification of fish oil from crude oil[11].

Table 1: *EPA and DHA (percentage of fatty acid composition) in some common cold water marine fish oils*[12,13]

Marine fish	EPA (C20:5)	DHA (C22:6)
Halibut (wild)	12.2	25.4
Anchovy	9-18.2	8.7-13
Sea bass	10.6	19.5
Sardine	12.4-14.5	9.8-12.5
Salmon	12.7-13.4	10-10.2
Tuna	4.6	18.3
Menhaden	10.6-13.7	6.4-9.2
Sand eel	10.9	9.7
Capelin	9.9	7.9
Herring	7.4-7.4	6.7-8.7
Mackerel	6.1-5.7	7-8.7

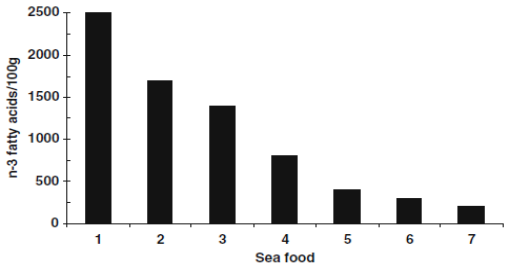

Figure 3. *N-3 Fatty acid composition of various seafood (fish)*[11]
1= Mackerel; 2= Anchovy; 3= Coho salmon; 4-Rainbow trout; 5=Pacific halibut; 6=shrimp; 7-lobster

Table 1: *EPA and DHA (percentage of fatty acid composition) of some selected fish from the Bay of Bengal coastal regions* [14,15,16]

Local name	Scientific name	EPA (C20:5)	DHA (C22:6)	Comments
Lotte/Loitta	*Harpadon nehereus*	8.09	17.15	India[13]
Hilsa shad/Ilish	*Tenualosa ilisha*	13.9	6.7	Sri Lanka[15]
	Hilsa ilisa/ Tenualosa ilisha	6.56	2.7	Bangladesh[14]
Pomfret/silver pomfret//Rup chanda	*Pampus argentius*	7.11	12.3	India[13]
Pabda	*Ompok pabo*	7.33	4.81	India[13]
Chhuri machh	*Tricherius salva*	5.06	4.06	India[13]
Vangan	*Mugil tade*	3.46	3.74	India[13]
Rohu	*Labeo rohita*	2.6	5.1	Farmed, India[17]

Apart from preventing Alzheimer's disease, regular consumption of fish can also reduce the risk of cardiovascular (heart) disease[19,20] and diabetes[14]. For example, low incidences of ischemic heart disease (acute or chronic cardiac disabilities) have been reported in coastal-dwelling Turkish and Japanese populations consuming fish and fish constituent-enriched diet. Lotte fish (*Harpadon nehereus*) oil (found in the Bay of Bengal region) could be beneficial against diabetes[14]. Currently world marine biodiversity including seafood organisms are at a greater risk of extinction and decline due to indiscriminate and illegal fishing and overfishing, coastal pollution and climate change. Therefore, protection and conservation of marine resources is essential so that human can continually benefit from these natural resources.

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