
FISH: THE HEALTHY FRIENDLY SPECIES

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ABSTRACT

Fish is a very important part of a healthy diet. Fish and other seafood are the major sources of healthful long-chain omega-3 fats and they are also rich in other nutrients such as vitamin D and selenium, protein, and low in saturated fat. There is strong evidence that eating fish or taking fish oil is good for the heart and blood vessels. Research over the past few decades has confirmed the importance of the nutritional components of fish in brain development and reproduction and highlighted a role for fish in a variety of other functions in the body. Much of the importance of fish in health has come from research into long chain polyunsaturated fatty acids (PUFA) of the n-3 family. The n-3 Fats are also generally known as omega 3 fats. Fish is a rich source of two important n-3 PUFAs, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Marine algae are the only form of life that can easily make long chain n-3 PUFA. As fish feed on algae, they become rich sources of these important n-3 fats which in turn transfer to humans through consumption of the former. In addition, fish is also a good source iodine, zinc vitamins A and some B vitamins. Fish intake has been on decline for many years based on different food consumption survey with alarming findings that some people never eating fish without any taboo attached. The level of fish intake has been linked with a lower risk of death from heart disease and likewise playing vital roles in preventing other illnesses such as arthritis, strokes, breast cancer, diabetes to mention a few. However, it is recommended by various finding that eating fish at least twice a week and including oil – rich fish at least once a week in diet will maintain healthy conditions against illnesses.

KEY WORDS: Fish, Healthy, Friendly, Species

INTRODUCTION

Fish has been an important component of food in many parts of the world. Its nutritive value has been due to the presence of certain health promoting substances. The consumption of fish rich in omega-3 has the potency of fighting heart disease in several ways by protecting the heart against the development of erratic and potentially deadly cardiac rhythm disturbances. Furthermore it lowers blood pressure and heart rates, improve blood vessel function, and, at higher doses, lower triglycerides and may ease inflammation. Holman (1998) reported that the awareness of health benefits of n-3 fats has increased tremendously since 1990s though omega-3 fatty acids have been known as essential to normal growth and health since the 1930s. Omega-3 fatty acids (n-3) play a well-recognized role for growth and development. Connor (2000) reported that n-3 Fatty acids favourably affect atherosclerosis, coronary heart disease, inflammatory disease, and perhaps even behavioral disorders. This is in agreement with (Holman, 1998) that inadequate content of these fatty acids in diets may enhance the risk for the development of disease.

The consumption of supplementary fish oil has been reported to reduce the risk of cardiac death and improve outcome in a variety of disease states, including sepsis (Barton *et al.*, 1991, Daly *et al.*, 1992), cystic fibrosis (Lawrence and Sorrell 1993), some forms of cancer (de Deckere, 1999), diabetes (Berry, 1997), rheumatoid arthritis (Kremer, 1996), Crohn's disease (Belluzi *et al.*, 1996), heart disease (Marchioli, 1999) and depressive disorders (Stoll, *et al.*, 1999). Harris *et al.*, 2007 reported that consumption of encapsulated fish oils resulted in similar fatty acid patterns to the intake of fish.

There is high rise occurrence of cardiovascular disease globally. In 1999, the United State Government reported that heart disease killed more Americans than cancer annually with recent evidence that cardiovascular risk in women has been increasing which resulted in killing more women than breast cancer

(United State Government (1999). However, up till 2010, vitamins have not been found to be effective as means of preventing cardiovascular disease rather than a prescribed medication while the primarily focused treatment has been considered to be the dietary pattern and the lifestyle intervention of the concerned (Ornish *et al.*, 1990; 1998).

Fish has been considered the best animal protein choice beside poultry. (Bernstein *et al.*, 2010) reportedly supported the evidence of Aune *et al.*, (2009) that replacing red meat with fish, poultry, beans, or nuts, could help prevent heart disease, and that reducing red meat intake can lower the risk of diabetes. The American Institute for Cancer Research (2007) recommends that less than 18 ounces or 522g of red meat per week should be consumed as well as avoiding taking processed meats such as hot dogs, bacon or ham in order to lower the risk of colon cancer. Processed meats, especially, have been most strongly linked with cardiovascular disease and diabetes, at least in part due to their high added sodium content. The low fat and high omega-3 fatty acids in fish have made it a healthy food and good source of animal protein. Research has reported that the risk of dying from heart disease could be reduced by 36% by eating 3 - 6 ounces (87 – 174g) of fatty fish like salmon, herring, mackerel or sardines weekly while the overall risk of death is greatly reduced by 17% (Mozaffarian and Rimm 2006). For these great benefits being mentioned, the Dietary Guidelines for Americans 2005 shared similar view with Kris – Etherton *et al.*, 2002 that individual should consider taking fish twice a week.

IMPORTANCE OF OMEGA 3

Low intake of Omega 3 fats in diet has been evident to contribute to a wide range of lifestyle diseases affecting human generation. However, for the organs and systems in the body to function at optimum level, the Omega 3 fatty acids contained in fish oil is needed even at minimum intake (Table 3) while its deficiency can increase the risk of having stroke and heart attack or death. Daviglius ML et al 1997 report was in conformity to Kromhout D et al 1995 that a little regular intake of fish rich in fish oil apparently supports the management of cardiovascular risk.

The essential fatty acids component, docosahexaenoic acid (DHA), being the most prevalent fat in our brain makes its adequate intake influence the development of cognitive abilities in infants as well as improve the memory for older people. Likewise, the DHA is particularly prevalent in the eye retina and its sufficient supply in the diet helps in the development of childhood vision as well as protecting the elderly from macular degeneration which is the most common cause of blindness amongst older people.

Rheumatoid arthritis can be a debilitating condition, typically strikes more women than men and can be present as early as 30 years old. The prominent symptoms are stiffness, painful and swollen joints, trouble sleeping and depression. It generally begins with tenderness in the hands, wrists or fingers but it can affect most joints in the body. Perfect consideration to personal diet can reduce or alleviate the discomfort of arthritis. Many arthritic conditions do not have a cure, but rely on over-the-counter and prescription medications. Both can be potentially dangerous and have long-term side effects but getting enough Omega 3 may help fight inflammation, joint pain and the stiffness that often accompanies the illness. Fish consumption like salmon, five days per week in addition to the balanced exercise program like walking, yoga and swimming to keep the muscles and joints flexible, will give a significant relief effect.

The essential fatty acids are known for their anti-inflammatory properties. Gradually it is becoming recognised that inflammation in the body is one of the major causes of so many lifestyle diseases. However the Omega3 fats, whilst being an effective anti-inflammatory, have no significant health side effects, unlike many of the anti-inflammatory drugs available.

Depression has become a validated and serious condition that is known to affect young and old alike. The effort of fighting feelings of despair or sadness can be tiring and life changing. But, before turning to drugs whose sole purpose is to alter brain waves there are a variety of steps that are safe, natural and helpful. Start with a lifestyle change. Exercise daily, drink a lot of water, stop smoking and avoid stressful situations. Next, make changes to your diet. Stay away from caffeine, overly processed food and alcohol, but add more fruits and vegetables and, most importantly, add more omega 3 fish oil. Naliwaiko (2004) reported similar result with the experimental study carried out by Su, Kuan–Pin *et al.*, (2003) that Omega-3 fatty

acids in fish oil is used for treating clinical depression while (Green Pnina (2006) and Yehuda et al., 2005) confirmed the use of n-3 fatty acids in fish oil in handling anxiety.

More than 25 million people suffer from agonizing headaches known as migraines. It is characterized by symptoms like vomiting, chills, lack of appetite, nausea and irritability. Typically more women experience migraines than men and a large percentage of women suffer from menstrual migraines. One specific nutrient that has been found missing in the diet of migraine sufferers has been omega 3 fatty acids. Found in fish like salmon and sardines, omega 3 contains high levels of DHA and EPA which may help reduce the pain often associated with migraines. Research has also suggested a correlation between low levels of DHA and EPA and a variety of health conditions, including headaches. The frequency and severity of migraines can be greatly reduced by avoiding foods such as sugar, fast foods, caffeine and chocolate, alcohol and smoking, noisy environment; and replace them with fruits, vegetables and most importantly fatty fish high in omega 3.

The pregnancy term is an important one for both baby and mother. It has been noted that a healthy lifestyle including healthy eating habits during pregnancy greatly increase the chance of having an intelligent healthy child, both during the pregnancy and post delivery periods. Research has suggested higher infant intelligence with proper levels of omega 3. There are parental benefits deriving from taking omega 3 or its supplements, such as less hormonal issues, increased blood flow, smaller risk for erectile dysfunction and greater sperm production. One of the most beneficial nutrients that affect the health of mother and child is omega 3 fatty acids and eating more of fish rich in n-3 fatty acids is of great significant. The child gets the needed nutrients during gestation process by adding omega 3 supplements. Palmquis, 2009 recommended the minimum daily intake of 200mg DHA for pregnant and lactating women.

Erectile dysfunction may be on a continuous rise even with several side effects from prescribed medication but research has suggested a connection between low sperm count, an inability to perform and low levels of omega 3. However, fish oil that is rich in fatty acids DHA, DPA and EPA, is the natural approach to create a healthy prostate as well as proper functioning of the male reproductive organ which thereby improves the sexuality of men.

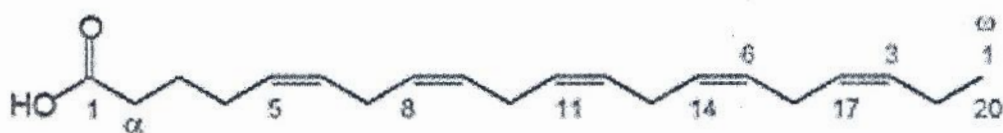
The omega-3-fatty acids inhibit proliferation of breast cancer cells whereas omega-6-fatty acids stimulate growth. There are evident research works that support omega-3-fatty acids as adjunct therapy in prevention and treatment of breast cancer such as the inhibition of the proliferation and metastasis of many cancerous cells such as malignant breast cells (Noguchi *et al.*, 1995); Epidemiology studies (Caygill *et al.*, 1996) and *in vitro* cell culture studies (Chajes *et al.*, 1995; Telang *et al.*, 1991). Moreover, the omega-3-fatty acids are useful in the treatment of inflammatory diseases (Ziboh 1992) including epithelial inflammatory diseases such as psoriasis (Grimminger and Mayser 1995; Endres *et al.*, 1995).

FISH AND OMEGA 3

Due to modern change in dietary habit, little fish in diet has been responsible for little Omega 3 fats consumption. In the time past, beef has significant levels of Omega 3 due to their grazing on nutritious grasses but such essential fatty acids are greatly diminished because most cattle are now primarily grain fed. The same applies to chicken and eggs, both of which were higher in Omega 3, but now reduced due to the modern farm feeding practices. However, research on the benefits of the Omega3 fats began when scientists were able to realize that populations of people who ate a lot of fish were saved from many lifestyle diseases commonly exhibited and suffered by others. Therefore, good diet including Omega 3 fatty acids helps in protecting the body from many different undesirable health conditions. The most abundant source of Omega 3 is in fatty fish of which the best can be found in fish such as salmon, sardines, tuna, anchovies, herring and mackerel.

FISH OIL FATTY ACID

Fish oil is derived from the tissues of oily fish and it contains omega-3 fatty acids eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), which are the precursors of eicosanoids that are known to reduce inflammation throughout the body. (Moghadasian, 2008 and Leslie *et al.*, 1992)



Chemical structure of eicosapentaenoic acid (EPA).



Chemical structure of docosahexaenoic acid (DHA).

It was evident by Palmquis (2009) that an increase in the intake of the fish oil fatty acids, especially DHA, will improve physiological and health outcomes during pregnancy and lactation, stresses of the immune system, cardiovascular disease, cancer and some mental and emotional conditions. The most widely available dietary source of EPA and DHA is found in cold water oily fish, such as salmon, herring, anchovies, and sardines.

EFFECT OF OMEGA 3

Omega 3 supplements are grouped into two; (i) oil gotten from sources like tuna and salmon, (ii) oil derived from sources such as flax and perilla. Human body delighted in fish oil due to its easy distribution and absorption compare to the plant derived oils which must be converted before absorption and even with minimal benefits. This conversion rate is typically less than 2%. Fish oil provides a higher and more beneficial quality of omega 3 without unwanted side effects. In general, side effects are thought of in a negative context, but in Omega 3 supplements they are in positive context and completely safe for all age brackets regardless of their current health status. The only negative side effect that could be experienced is the occasional belching condition from taking fish oil which is short lived and as soon as the body system stabilized, belching effect disappears whereas the positive side effect are numerous such as flexible vessels, lower cholesterol, better circulation, less arthritis pain, diabetes and heart disease, fewer headaches and better vision to mention a few.

FISH OIL AND HEAVY METALS

Consumers of oily fish should be aware of the potential presence of heavy metals and fat-soluble pollutants such as PCBs and dioxins, that are known to accumulate up the food chain. Toxins like PCB and mercury have been found at alarming levels in many cultured fish and these toxins are easily transferred. Although (Foran *et al.*, 2003) has reported that fish oils have reduced mercury contamination compares to fish and may provide a better long term source of LCn-3. Researchers from Harvard's School of Public Health after extensive review, reported in the *Journal of the American Medical Association* (2006) that the benefits of fish intake generally surpasses the potential risks.

Fish do not primarily produce omega-3 fatty acids, but instead accumulate them from either consuming microalgae that produce these fatty acids, as is the case with fish, like herring and sardines, or fatty predatory fish like shark, sword fish, tilefish and albacore tuna which prey on fish that have accumulated omega-3 fatty acids from microalgae. Such fatty predatory fish may be high in omega-3 fatty acids, but due to their position at the top of the food chain, these species can accumulate toxic substances. For this reason, the U.S. Food and Drug Administration recommends limiting consumption of certain (predatory) fish species (e.g. albacore tuna, shark, king mackerel, tilefish and swordfish) due to high levels of toxic contaminants such as mercury, dioxin, PCBs and chlordan.

TABLE 2: QUANTITY OF OMEGA 3 IN FISH CONSUMPTIONGrams of $n-3$ per 85g serving of popular fish.

Common name	grams $n-3$
Herring, sardines	1.3-2
Spanish mackerel, Atlantic, Pacific	1.1-1.7
Salmon	1.1-1.9
Halibut	0.60-1.12
Tuna	0.21-1.1
Swordfish	0.97
Greenshell/lipped mussels	0.95
Tilefish	0.9
Tuna (canned, light)	0.17-0.24
Pollock	0.45
Cod	0.15-0.24
Catfish	0.22-0.3
Flounder	0.48
Grouper	0.23
Mahi mahi	0.13
Orange roughy	0.028
Red snapper	0.29
Shark	0.83
King mackerel	0.36
Hoki (blue grenadier)	0.41
Gemfish	0.4
Blue eye cod	0.31
Sydney rock oysters	0.3
Tuna, canned	0.23
Snapper	0.22
Eggs, large regular	0.109
Barramundi, saltwater	0.1
Giant tiger prawn	0.1
Lean red meat	0.031
Turkey	0.03
Cereals, rice, pasta, etc.	0
Fruit	0
Milk regular	0
Regular bread	0
Vegetables	0
Vegetable oils and spreads	0

Kris-Etherton, Penny M.; William S. Harris, Lawrence J. Appel (2002). "Fish Consumption, Fish Oil, Omega-3 Fatty Acids, and Cardiovascular Disease". *Circulation* 106 (21): 2747-2757.

EU REGULATION ON ACCEPTABLE LIMIT OF TOXICANTS IN FISH RICH IN OMEGA 3 FATTYACID

The percentage limit of the toxin that can be present in the oil for it to be effectively beneficial to the consumer is being regulated by the European Union (EU). Recently, concerns in the UK and Ireland with regards to upholding the limits set have resulted in some major manufacturers taking their products off the market on a temporary basis.

A lawsuit filed in March 2010 by a California environmental group claims that eight popular brands of fish oil supplements contained excessive levels of PCBs, including CVS/pharmacy, Nature Made, Rite Aid, GNC, Solgar, Twinlab, Now Health, Omega Protein and Pharmavite. (Elisabeth (2010) and San Francisco Chronicle, March 3, 2010). The majority of these products were either cod liver or shark liver oils and the liver being the major filtering and detoxifying organ, the PCB content will be much higher in such products than in the more common fish oil produced from the processing of whole fish.

RECOMMENDATION ON FISH INTAKE

Adding fatty fish like sardines, mackerel and salmon will add additional vitamins and nutrients that the body needs on a daily basis. These fish have higher levels of the beneficial oils than their lean counterparts and may have the ability to have an effect on health conditions like strokes, heart disease, arthritis, breast cancer and many more. Several of the well known institutions such as the American Heart Association are advising that everyone both children and adults should add fish oil to their dietary intake while others e.g IOM recommends nutrients. Therefore, whether the recommendation is for fish or for EPA +DHA, the resulting EPA +DHA values typically fall between 200 and 600 mg/d.

TABLE 3 : Recommendations for fish and/or EPA + DHA intakes for healthy adults from government and health organizations worldwide

Organization	Year	Recommendation
Eurodiet Conference (Eurodiet. 2000).	2000	200 mg/d
Agence Francaise de Se'curite' Sanitaire des Aliments, Centre national de coordination des e'tudes et recherches sur la nutrition et l'alimentation, and Centre national de la recherche scientifique (France) (Martin A. 2001).	2001	500 mg/d
UK Scientific Advisory Committee on Nutrition serving (United Kingdom Scientific Advisory Committee on oily, Nutrition (SACN), Committee on Toxicity, 450mg/d	2004	Fish twice/wk, 1 of which should be minimum intake
International Society for the Study of Fatty Acids and Lipids (International Society for the Study of Fats and Lipids (ISSFAL) 2004)	2004	500 mg/d
Australia Department of Health and Ageing (Australia and New Zealand) (. Australian Department of Health and Ageing, National Health and Medical Research Council. 2005). mg/d for al. 2006)	2005	442 mg/d for men, 318 Women (Howe P,et

American Heart Association (Lichtenstein AH et al 2006) (preferably oily)	2006	2 servings/wk of fish
Health Council of the Netherlands (Health Council of the Netherlands. Guidelines for a serving of which healthy diet 2006 achieve the (n-3)	2006	Fish twice/wk, 1 should be oily, to DRI of 450 mg/d of LCPUFA
Superior Health Council of Belgium (Superior Health Council of Belgium. Advisory report 2004) energy for	2006	Minimum of 0.3% adults (~667 mg/d)
American Dietetic Association/ Dietitians of Canada (Kris-Etherton PM, Innis S, American Dietetic Association, Dietitians of Canada.2007) servings oily	2007	Fish twice/wk, both or 500 mg/d

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