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Consumption of fish in stroke-risk aversion by fish and fish oil consumption: A review

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Abstract
A Cardiovascular disease (also called heart disease) is a class of diseases that involve the heart, the blood vessels, arteries, veins or capillaries. According to the World Health Organization, 15 million people suffer stroke worldwide each year. It has been found that there is a decreased prevalence of stroke development in people who habitually add a meaningful fish quantity to their meal menu. Series of research works has been carried out to ascertain this claim. According to series of findings, varying results were observed in both males and female volunteers, which tend to be more positive in females. However, the results are seen to be applicable for both genders. Fish and omega-3 fatty acid consumption of at least 3-times a week is seen to be very beneficial especially for the reduced risk of cardiovascular diseases and thrombotic infarction. The other important factors which are seen to reduce the risk of stroke alongside the consumption of omega-3 fatty acids in fish include, decreased salt consumption, reduced tobacco smoking, treating active lifestyle diseases, and having a healthy daily diet.

Keywords: Ischemic stroke, omega-3 fatty acids, fish, diet

1. Introduction

Out of the 15 million stroke prone people 5 million people die and another 5 million are permanently left in a disabled physical state [1]. A recent systematic review and meta-analysis of 56 population-based stroke incidence studies in the world showed that the rate of stroke incidence has declined in developed countries, but has grossly increased in the large developing countries by over 100%, and now exceed the level of stroke incidence in the developed (high-income) countries by 20% [3]. However, research has to an extent verified the risk decrease in stroke development mostly in people who consume fish in an average meal of 3 times per week. This is due to the fact that fish contains certain fatty acids which help in this risk reduction.

1.1 Fish: A fish is any member of a group of organisms that consist of all gill-bearing aquatic craniate animals that lack limbs with digits. They are broadly classified into fin and shell categories. The fin fishes are every fish that are known to possess fins which are used for movements in fishes, and they have internal skeletal system. While the shell fishes are the fish species which do not possess fins, but shells. They also have exoskeletal system. Fishes are found in different species and types in various water bodies, from the fresh waters to sea waters. They also are known to be cultivated in fish farms based on the farmer's preference. Fishes has been serving as a source of food to man since the Stone Age. The consumption of fishes in meals has been from time immemorial. However, different preparation patterns and procedures have evolved which also determines its palatability and nutrient availability.Omega-3 fatty acids have been seen over the years to be a very important health friendly food component to be included in the regular diets based on its multi-purpose heart-healthy functions. They have been seen to be helpful in averting various cardiovascular diseases, parts of which are in. Fat composition varies: Cod, haddock, rock fish & sole: < 1%, Salmon, mackerel & butterfish: 25% fat, Protein ~ 20% & Mineral ~ 1.5%, Oysters are notable for their high content of glycogen, on an average of 2-3%. Protein: 20% (BV=80), Rich in lysine and methionine hence it has supplementary value with cereals and pulses. Fats: 1-2.8% and are Rich sources of n-3 fatty acids

1.2 Hyperlipidemia: Various experimental studies have revealed the wonder working action of the hypolipidemic effect of omega-3 fatty acids from fish, in subjects with Hypertriglyceridemia and Type-IIb, Hyperlipidemia and Type-V Hyperlipidemia. The patients experienced a great reduction in plasma cholesterol and concentrations of triglyceride. Also great reduction was seen in the subjects VLDL (Very Low Density Lipoproteins), LDL (Low Density Lipoprotein), Chylomicrons levels. The mechanism was seen to be that omega3-fatty acids reduce the synthesis of triglycerides and VLDL in the liver. Ultimately, plasma VLDL and LDL is decreased which hence reduces saturated fats and dietary cholesterols [29].

1.3 Congestive Heart Failure: PUFA, in which omega-3 fatty acids is a family, has been seen to contain anti-coagulants which is necessary for the reduction in Triglycerols, as coagulation activity was seen to be diminished in the plasma. It has been postulated that triglycerol and coagulation factors synthesis are controlled by a common hepatic factor which is inhibited or modulated by fish oil, therefore controls their production [30].

1.4 Ischemic Heart Disease: Ischemic heart disease is where Atherosclerosis affects the coronary arteries in the heart. If the flow of oxygen-rich blood to the heart muscle is reduced or blocked, angina (an-JI-nuh) or a heart attack may occur. This oxygen shortage in the heart is caused majorly by the build-up of plaques in the blood vessels, which prevents the easy and

smooth passage of blood within them. Omega-3 fatty acid also has a record of preventing this deadly cardiovascular disease by reducing and or removing the plaques formed in the blood vessels. The presence of the anticoagulant in fish and fish oil's omega-3 fatty acid make this effect possible.

1.5 Stroke: Stroke is a type of cardiovascular disease affecting the blood supply to the brain. It is also referred to as cerebrovascular disease or apoplexy. A stroke occurs when a blood vessel which carries oxygen and basic food nutrients to the brain either bursts, ruptures or is blocked by a clot caused by clogs. As a result of these, the brain cannot get the blood and oxygen it needs and pieces of the brain die which leads to some physical disability in such patient. According to the World Health Organization, 15 million people suffer stroke worldwide each year. Out of these, 5 million people die and another 5 million are permanently left in a disabled physical state [1]. There are two major categories which stroke is being classified into. They are: ischemic and hemorrhage. Ischemic strokes are caused by a lack of blood flow to the brain and they account for 70 percent or more of all strokes conditions. Hemorrhagic strokes are caused by bleeding into the brain or adjacent tissues which are caused by the rupturing of certain weak blood vessels.

A recent systematic review and meta-analysis of 56 population-based stroke occurrence studies in the world showed that the rate of stroke incidence has declined in developed countries, but has grossly increased in the large developing countries by over 100%, and now exceed the level of stroke incidence in the developed (high-income) countries by 20% [3].

Another recent and reliable data on stroke risk factors gotten in developing countries were reported in the INTERSTROKE case– control study where 2578 of the 3000 participants (86%) were from the low- to middle-income countries [6]. In that report, only 5 modifiable risk factors (hypertension, current smoking, abdominal obesity, low physical activity, and unhealthy cardiovascular diet) was seen to be responsible for more than 80% of the risk of developing ischemic stroke and intracerebral hemorrhage [3]. Raised blood pressure, (primarily due to increased consumption of salt) and smoking of tobacco in men accounts alone for 54% and 12% respectively of stroke mortality [2, 7] and there is evidence of stronger relationships between blood pressure and stroke risk in developing countries than that in developed countries [8, 28].

The known causes of stroke sometimes include the definite markers such as cigarette/ tobacco smoking, excessive consumption of alcohol, drug use (cocaine, amphetamines), age, sex, family history and genetic factors. Certain possible markers are: use of oral contraceptive, diet, personality type, geographic location, socio-economic factors, physical inactivity, obesity, abnormal blood lipid levels. In the same vein, some diseases also lead to the development of stroke. They may include Hypertension, Cardiac disease, Transient Ischemic Attack (TIA), Diabetes mellitus, Sickle cell disease [26].

A cross-sectional study of vascular risk factors in rural sub-Saharan Africa revealed a high prevalence of smoking, hypertension, and obesity among women [4]. Approximately 70% of those with high blood pressure were not taking any treatment for it. A combination of these risk factors compounded by a lack of pharmacological treatment for hypertension is likely to contribute to the high prevalence of stroke in the region [5]. Changes in diet pattern and lifestyle in the past 20 to 30 years, with a significant increase in the consumption of salt, fats, and tobacco, are associated with a marked increase in the prevalence of hypertension in Asian countries, including India and China [6].

Stroke may clinically present its patients with Sudden weakness or numbness of the face, arm, and leg on one side of the body, Loss of speech, or trouble speaking or understanding speech, Dimness or loss of vision, particularly in only one eye or half of both eyes, Sudden onset of blurred or double vision, Unexplained dizziness, Sudden onset of unsteadiness, lack of coordination, difficulty walking, or falling, Sudden excruciating headache and Recent change in personality or mental abilities, including memory loss [26]. Other common, but not universal, problems that may occur following a stroke incidence include: poor concentration, poor judgment of time, disturbed sleep cycles, impaired memory, impaired judgment, loss of sexual desire, poor emotional control, and depression [26].

According to the World Health Organisation, High blood pressure contributes to more than 12.7 million strokes worldwide. Europe averages approximately 650,000 stroke deaths each year [27]. Stroke is a life and wellbeing threatening ailment. It may not seem to be rampant but it still ranks high in the death causes. According to the U.S. Centers for Disease Control and Prevention, stroke is the third leading cause of death in the United States, and fifth globally (having cardiovascular diseases at the top). More than 140,000 people die each year from stroke in the United States. Stroke is the leading cause of serious, long-term disability in the United States [10]. As researchers learn more about the mechanisms of stroke, they are realizing that it is not simply a lack of blood flow that causes death of tissue; a progression of other processes (including inflammation and toxic build-up), called the ischemic cascade, and may play an even greater role in causing lasting neural damage. Doctors believe that if they can interrupt this cascade, they may be able to prevent the devastating brain damage that was once the inevitable consequence of stroke [26].

The consumption of Healthy Fatty acids such as the omega-3 fatty acids has been seen in several findings to be a way of preventing most cardiovascular and lifestyle diseases such as diabetes mellitus, high cholesterol levels, obesity, amidst other diseases [11, 13]. These highly health-friendly fatty acids are seen to be present in certain plants and animal fats. They are present in plants fat as linolenic fatty acid in safflower oil, walnuts, soybeans etc. And they are available in animal fats as Eicosapentaenoic acid (EPA) and Docosahexaenoic acids (DHA) in Fishes.

It has been affirmed that fish consumption may reduce the risk of stroke. Fish contains long-chain omega-3 polyunsaturated fatty acids, which have been proven to have both antiatherosclerotic and antithrombotic effects [13, 15, 19].

1.6 Omega-3 fatty acids: Omega-3 fatty acids which are also called ω-3 fatty acids or *n*-3 fatty acids [15] are polyunsaturated fatty acids (PUFAs) with a double bond (C=C) at the third carbon atom from the end of the carbon chain [16]. The three types of omega-3 fatty acids involved in human physiology are α-linolenic acid (ALA) (found in plant oils), Eicosapentaenoic acid (EPA), and Docosahexaenoic acid (DHA) (both commonly found in marine oils). Marine algae and phytoplankton are primary sources of omega-3 fatty acids [15].

While many existing literatures suggests a potential benefit of high intake of fish in reducing risk of stroke, particularly ischemic stroke which is observed to be more averted in women

[14, 25], this may only relate to certain sorts of fish, such as fishes high in n–3 fatty acids. High fish intake that contains mainly of fish low in n–3 fatty acids may not have the same effects as those fishes containing a high amount of n-3 fatty acids. Also we should note that this finding is seen to reduce the risk of ischemic stroke rather than hemorrhage stroke [17, 18, 19].

The identified mechanism for the reduced risk of stroke by adequate fish consumption was seen to include the inhibition of platelet aggregation [24, 23], suppressed formation of lipid mediators (leukotrienes) [22] and the reduction of plasma fibrinogen [21] blood pressure levels and insulin resistance [20]. It was sometime stated that Fish caught in the wild, as opposed to those that are farmed, tend to have higher levels of the fatty acid. Here's a group classification of fishes, with their percentages of omega-3 fatty acid content.

Table 1

Groups	Fish and it's omega-3 content
Group I	Mackerel (1.8%), lake trout (1.6%), herring (1.5%), sardines (1.4%), albacore tuna (1.3%), salmon (1.1%)
Group II	Halibut (0.6%), river trout (0.5%), catfish (0.4%)
Group III	Cod (0.3%), snapper (0.2%), tuna packed in water (0.2%)

2. Discussion

It has been seen that the consistent and habitual consumption of fish and omega-3 fatty acids are health friendly and important for reducing the risk of a person developing ischemic stroke and preventing myocardial infarctions. The results derived in series of works done have proven this postulate to be dependable, even though other lifestyle factors are involved in asserting this claim.

2.1 Summary

This review stresses the importance of consuming healthy oily fish in the diets as it helps reduce the high risk of developing stroke, thrombotic infarct and myocardial infarction. Fish and omega-3 fatty acid consumption of at least 3-times a week is seen to be very beneficial especially for the reduced risk of cardiovascular diseases and thrombotic infarction. The other important factors which are seen to reduce the risk of stroke alongside the consumption of omega-3 fatty acids in fish include, decreased salt consumption, reduced tobacco smoking, treating active lifestyle diseases, and having a healthy daily diet.

3. Conclusion

The ample heart-healthy effects supplied by the omega-3 fatty acids in fishes and fish oil cannot be over emphasized. Different reviewed studies, indicates that the minimal consumption of fish for at least 3 times in a week irrespective of gender, is very beneficial to a person's cardio-vascular health (aside other benefits). Hence, an average daily fish or krill meal of 500mg is recommended to non-vegetarians. Krill and krill-oil has also been found to contain an ample amount of Poly Unsaturated Fatty Acids (PUFA), and omega-3 fatty acids precisely. Plant-based omega-3 fatty acids (contained in flaxseed, flaxseed oil, chia seeds, walnuts and leafy greens in the form of ALA), cannot completely replace DHA and EPA because less than 0.9% of ALA is converted to DHA and EPA in the body in the presence of certain enzymes which are still deficient in many people.

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