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1. Food Fishes and Their Importance in Human Diet

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Abstract:

Fish is the important or only source of animal protein in many underdeveloped nations, and it is critical for giving micronutrients to vulnerable populations. Fish is high in a range of nutrients, including omega-3 fatty acids, proteins, selenium, iodine, vitamin D, and taurine. Fish is essential for preventing non-communicable diseases because it is low in saturated fats. Consuming seafood in moderation has been associated with a decreased risk of Alzheimer's disease. Nutrients found in fish are very helpful in aiding athletes' muscle regeneration and recovery from exhaustion. Mercury levels in several seafood varieties are high. Furthermore, the marine environment now has an accumulation of microplastic due to human activity. it's important to make sure to prepare fish at the right temperature to prevent food infection.

Seafood, particularly fish, is regarded as one of the healthiest foods on the planet due to its high levels of omega-3 and omega-6 fatty acids, vitamins, and a range of other nutrients. Fish benefits also include the diverse taste and texture of each fish species, allowing to enjoy a different flavour every day. Fish is a nutritious food that plays an important role in human nutrition. For generations, fish has been a staple in the diets of coastal Indians. It is simple to find and prepare, and it can be fried, boiled, baked, or roasted. It has a delicious flavour as well as health benefits. Fish is essential in the fight against hunger and malnutrition.

A greater emphasis on fish and nutrition benefits both developing and developed countries. Fish is the important or only source of animal protein in many underdeveloped nations, and it is critical for giving micronutrients to vulnerable populations.

Fish can occasionally be used to treat pre-existing health issues. Goitre, for example, is common in locations where iodized salt is lacking, but eating fish and the natural iodine it contains may help lessen these cases.

Fish is high in a range of nutrients, including omega-3 fatty acids, proteins, selenium, iodine, vitamin D, and taurine. Current dietary recommendations from several governing authorities suggest eating fish one to three times per week.

Fish is classified as lean, medium-fatty, or fatty based on the quantity of fat in its body tissue; fatty fish has more than 8 g of fat per 100 g, medium-fatty fish has 2-8 g of fat per 100 g, and lean fish has less than 2 g of fat per 100 g. While the amount of fat in fatty fish fluctuates greatly, it is generally consistent in lean fish. Fish of different species have different nutrient contents and concentrations; the biggest variations are found in fatty and lean fish. Lean fish has more taurine and iodine than fatty fish, but fatty fish has more n-3 fatty acids and fat-soluble vitamin D.

Because of their high micronutrient density, small indigenous fishes (SIFs) may play a key role in the elimination of diseases caused by micronutrient deficiencies. A few micronutrients, such as vitamin D in fatty fish and/or minerals like iodine, selenium, magnesium, zinc, and calcium, are more prevalent in aquatic creatures than in other sources, such as animal meats or plants.

Fish is superior to other animal and plant sources because it is not only a highly nutritious diet but also comes in a wide variety of pricing. Being able to reach individuals from various socioeconomic backgrounds—high, medium, and low—makes them one of the most widely consumed forms of animal protein.

1.1 Nutritional Benefits of Fish:

- **Proteins and Amino Acids:**

Sufficient protein intake promotes the health of the body, blood, and immune system. Indian diets are very low in protein, with the exception of regions where seafood is readily available. Protein is found in every cell in our body and is necessary for nearly all bodily functions. All nine amino acids are found in fish, making it a good source of protein. Fish has a special blend of superior proteins.

This shows the degree of satiety. It's been discovered that fish, such tuna, works better than turkey and egg to suppress hunger and food intake while also promoting a higher insulin response.

Compared to other animal protein sources like beef and chicken, fish is a high-quality source of protein that has a better satiety impact. The majority of these fish, according to their nutritional makeup, can offer up to 30% of the daily required amount of protein, which is significantly more than most frequently used pulses that are ingested in huge numbers.

These fish also contribute as much or more than other types of animal protein, such as pork, eggs, and milk, to the necessary daily intake of protein. Fish high in lysine and aspartic acid are found in cold water; leucine is found in marine fish; histidine is found in small native fish; and glutamic acid and glycine are found in carps and catfish.

It has been discovered that fish proteins improve postprandial levels, fasting lipid profiles, and both. It has been proposed that dietary proteins control lipid metabolism, slow down lipid production and absorption, and increase lipid excretion. Those who are insulin-resistant have been discovered to have improved insulin sensitivity when they eat fish like cod as opposed to other animal proteins.

- **Omega 3 Fatty Acids:**

Omega-3 fatty acids can be obtained in large amounts by eating fish. These vital nutrients maintain the health of the heart and brain. DHA (docosahexaenoic acid) and EPA (eicosatetraenoic acid) are two omega-3 fatty acids that are present in fish. Since the human body is unable to synthesize omega-3 fatty acids, it must be obtained from the diet.

All types of fish contain omega-3 fatty acids, however fatty fish have the highest concentration. Salmon, trout, sardines, herring, tinned mackerel, canned light tuna, and oysters are a few healthy options.

Polyunsaturated fatty acids, or omega-3 fatty acids, are naturally occurring compounds found in seafood like fish and algae as well as plants like soybeans, mustard, walnuts, and linseed. Lean fish is also a source of n-3 fatty acids, as it contains about 260 mg of n-3 per 100 g.

The long-chain n-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are mostly found in fatty fish. The biological activities of EPA and DHA include preserving the integrity of the cell membrane, regulating inflammatory processes, and reducing the release of pro-inflammatory cytokines, which have an impact on thrombosis and lipid metabolism.

In vitro studies have demonstrated the potential anti-inflammatory properties of EPA and DHA. Specifically, it has been observed that n-3 PUFAs control pro-inflammatory cytokines, such as TNF-α and IL-6, in macrophages. Notably, DHA appears to specifically lower TNF-α levels.

It has been demonstrated that omega-3 fatty acids inhibit the mechanisms that lead to lipid accumulation and regulate the pathways governing fat mobilisation and storage. A

required dose of EPA and DHA (250.0 mg/d) can be achieved by consuming two to three meals per week of a variety of seafood. The benefits of n-3 fatty acids (fish oil), which have been shown to have positive effects on Waist circumference, decreased triglyerides, raised HDL-C, and lowered blood pressure, are supported by current research on cardiovascular risk factors.

Fish is essential for preventing non-communicable diseases because it is low in saturated fats. Being one of the most abundant sources of omega-3 fats, it serves to mitigate the risk associated with cholesterol. One of the best fats for our health is omega-3, which guards against heart disease and stroke. Omega-3 has also been connected to enhancing immunological response and reducing inflammatory responses in the body.

Consuming foods high in omega-3 fatty acids has been shown to help people with arthritis who lead active lifestyles better manage their pain and fatigue. Studies have demonstrated some advantages for diabetes, Alzheimer's, dementia, ADHD, depression, and other conditions. Among the suggested fish are tuna, mackerel, trout, sardines, herring, and salmon.

Fish contains vitamin D, which has been linked to strong bones. According to recent scientific research, it also guards against Type-1 diabetes and malignancies of the oesophagus, colon, breast, and prostate. Vitamin B2, or riboflavin, is another vitamin that is found in good amounts in fish and is necessary for general health. In addition to encouraging growth, it also optimises the body's usage of oxygen and aids in the breakdown of carbohydrates into energy.

Omega-3 fatty acids have been linked to reduced blood pressure, triglycerides, 2-hour glucose, and elevated HDL-C when high and low intakes of the fatty acid were contrasted. The many health advantages of eating small, entire fish that still contain nutrients in their bones and skin, as well as fatty fish strong in omega-3 fatty acids, demonstrate the unparalleled nutritional worth of seafood.

a. By lowering blood pressure and lowering the risk of heart attacks, irregular cardiac rhythms, strokes, and sudden death, it helps maintain a healthy heart.
b. Promote normal brain development and the growth of the baby's nerves and eyes throughout pregnancy.
c. May delay inflammation and lower the risk of arthritis.
d. May lower the risk of diabetes, depression, ADHD, Alzheimer's disease, and dementia.

- **Vitamin D**

In addition to being crucial for calcium homeostasis and bone health, fat-soluble vitamin D may also have anti-inflammatory properties on human immune cells. Fish naturally contain vitamin D.

Vitamin D is mostly found in fatty fish; however, farmed salmon appears to be losing vitamin D, potentially as a result of changes in fish diets over time.

Recommendations for fish consumption alone typically fall short of optimizing vitamin D status, and fortification of various foods—like margarine—is a widespread practice in many nations.

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- **Vitamin B Complex**

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In addition to encouraging growth, it also optimises the body's usage of oxygen and aids in the breakdown of carbs to release energy.

- **Iodine:**

Iodine is necessary for the thyroid gland's proper operation since it helps to produce the hormones triiodothyronines (T3) and thyroxine (T4). The highest concentrations of iodine are found in lean fish, with cod and haddock having 10 times the amount of iodine as fatty fish like salmon and trout.

The recommended daily intake (RDI) of iodine for people is 150 micrograms per day, which is thought to be the right quantity to support adequate T4 synthesis without overstressing the thyroid. Patients with Metabolic syndrome have been reported to have larger thyroid volumes.

It's possible that obesity poses a separate risk for iodine insufficiency. It's possible that obesity poses a separate risk for iodine insufficiency. Obesity has been linked to both low and non-existent iodine supplementation.

During pregnancy, iodine is essential for the brain development of the foetus. In addition to keeping the thyroid functioning normally and preventing goitre, it aids in the enhancement of children's cognitive abilities.

- **Selenium**

Selenium's main roles in metabolism of thyroid hormone and antioxidant activity are as a co-factor.

Hypothyroidism is frequently associated with weight gain, decreased thermogenesis, and a slower metabolic rate because thyroid gland diseases affect body weight, thermogenesis, and lipolysis in adipose tissue.

The recommended daily intake (RDI) for selenium is 60 micrograms for men and 50 micrograms for women. Elevated selenium levels may mitigate the negative effects of mercury on blood pressure.

- **Iron:**

Iron is necessary for the maintenance of haemoglobin in the blood as well as for the immune system, gut, and body temperature regulation. A healthy energy level and avoidance of weariness are guaranteed by adequate dietary iron.

- **Zinc:**

Fish are a good source of zinc, which is necessary for a strong immune system. Even though the body only needs extremely small amounts of it, it is crucial since it serves to promote the action of over a hundred enzymes that are necessary for proper bodily function.

- **Magnesium:**

Human body need trace amounts of magnesium, which is another element. Magnesium helps to activate vitamin D and ensures that calcium enters the bones, both of which are important aspects of calcium metabolism. Due to its vital involvement in the metabolism of carbohydrates, magnesium is significant for people with diabetes.

It keeps the heart's muscles healthy and facilitates the flow of electrical impulses. It is also linked to a decreased risk of atherosclerosis and hypertension.

- **Potassium:**

It is an essential nutrient that is present in all body fluids. It is required for efficient cell function. Low potassium can cause salt sensitivity, high blood pressure, bone deterioration, kidney stone risk, and urine excretion of calcium.

Fish and all meats are good sources of potassium. Eating fish has several health benefits and is a healthy meat choice.

In contrast to red meats, it is associated with no negative health effects and is advised as a component of a balanced diet to preserve general health.

- **Contains astaxanthin:**

Salmon and other fish are high in astaxanthin. Belonging to the carotenoid family, astaxanthin possesses a high concentration of antioxidants. A substance known for having a number of potent health benefits is astaxanthin. Because astaxanthin increases levels of HDL (good) cholesterol and decreases the oxidation of LDL (bad) cholesterol, it appears to reduce the risk of heart disease. Additionally, it lowers oxidative stress, lessens inflammation, and guards against the artery-clogging accumulation of fatty plaque, all of which may lower the risk of heart disease. Fish contains omega-3 fatty acids, which help to prevent inflammation in the brain and nervous system. It helps maintain skin looking youthful and helps prevent skin damage. Additionally, it protects skin, increases skin suppleness, and lessens the appearance of wrinkles.

1.2 Health Benefits of Fish:

- **Fish aids in weight loss:**

Its high protein content helps balance the hormones that govern hunger and keep feeling full. Studies indicate that the combination of an active lifestyle and the omega-3 fats found in fatty fish may help obese individuals lose weight and reduce their abdominal fat.

- **It Lowers the Chance of Alzheimer's**

For the brain, fish is a vital food. Consuming seafood in moderation has been associated with a decreased risk of Alzheimer's disease. Regular fish eaters had higher levels of grey brain matter, which prevents brain degeneration and shrinking that can cause issues with brain function, according to numerous studies.

- **It Can Help Lower Symptoms of Depression**

Seafood has incredible benefits for mental well-being. When used with an antidepressant such as a selective serotonin reuptake inhibitor (SSRI), fish oil can help reduce the symptoms of depression. Omega fatty acids can also be beneficial to mental wellness. There is strong evidence connecting omega-3 fatty acids to a decrease in depression symptoms. Some antidepressant drugs have been found to be more effective when taken with omega fatty acids, perhaps because these fats promote better brain function.

- **It Enhances Eye Health and Vision**

Fish contains omega-3 fatty acids, which are good for eyes and vision. This is due to the fact that the eyes and brain are highly dependent on omega-3 fatty acids for proper development and maintenance of their health. One of the finest foods to obtain these healthy fats, such as omega 3 fatty acids, is fish.

- **Induce Sleep:**

Eating fish has been shown to enhance sleep quality. This is because fish provides vitamin D, which promotes restful sleep.

- **It Helps Reduce the Pain of Rheumatoid Arthritis**

Increased fish consumption actually reduces rheumatoid arthritis disease activity. It aids in easing pain and swelling as well as reducing chronic inflammation.

- **It Lowers the Chance of Immune Disease**

In fact, eating fatty fish can help avoid autoimmune conditions like type 1 diabetes. The high vitamin D content in fish enhances glucose metabolism and the immunological system.

- **It Reduces Cancer Risk**

Some malignancies can be prevented by eating fish. According to the study, individuals who consumed more fish than those who consumed less had a decreased chance of developing digestive malignancies, including cancers of the mouth, throat, colon, and pancreas.

- **Aid in Reducing Inflammation**

The majority of chronic illnesses, such as cancer, diabetes, and heart disease, have inflammation as their primary cause.

Fish can offer effective defence against persistent inflammation. Consuming more seafo

od, including fish, may help lower a number of inflammatory biomarkers. Lower levels of white blood cells, which are frequently employed as a gauge of chronic inflammation, were linked to frequent fish consumption.

It was discovered that taking fish oil supplements dramatically lowered levels of a number of particular inflammatory indicators, such as CRP, IL-6, and TNF-alpha.

- **Enhance Metabolism:**

Fish is a good source of omega-3 fatty acids, which are good for metabolism. In older women, this healthy fat increased fat oxidation and metabolic rates during rest and exercise.

- **It Reduces Blood Pressure**

Because fish oil has a high concentration of omega-3 fatty acids, it can help decrease blood pressure.

- **It Boosts Focus and Duration of Attention:**

Adolescents with focus and concentration issues have also been demonstrated to benefit from fish.

- **It Reduces the Symptoms of PMS:**

Fish can help women with their premenstrual symptoms as well. The study discovered that when women increased their intake of omega-3 fatty acids—found in most fish—premenstrual symptoms significantly decreased in their interference with daily life.

- **Treatment for Liver Disease:**

Fish rich in omega-3 fatty acids can help alleviate liver illness. Lowering the risk of fatty liver disease, omega-3 aids in the breakdown of fatty acids and triglycerides in the liver.

- **It Facilitates Quicker Athlete Recovery:**

Nutrients found in fish are very helpful in aiding athletes' muscle regeneration and recovery from exhaustion.

Most fatty fish are high in omega-3 fatty acids and vitamin D, which are important for fatigue recovery and muscle repair after exercise.

- **Enhanced mental well-being:**

Fish are high in omega fatty acids, a form of fat. Maintaining the health of the brain requires these lipids. Low blood levels of omega-3 fatty acids have been linked to cognitive decline and memory loss as well as accelerated brain ageing.

These low omega fatty acid levels have really been connected to brain Reducing inflammation, lowering blood pressure, lowering the risk of cancer, and enhancing the function of the cells lining the arteries are just a few of the remarkable health advantages associated with EPA and DHA.

1.3 Certain Seafood Contains a Lot of Mercury:

Mercury levels in several seafood varieties are high. The age, size, and water the fish lived in are some of the variables that affect the amount of mercury in seafood. The body absorbs mercury easily, and if too much builds up in the tissues, it can have negative health effects. Fish obtained from the ocean often contain high levels of mercury, which can be harmful in big doses. The mercury that these fish ingest is stored in their fat, where it can accumulate over time. While albacore, swordfish, and mackerel are known to have high mercury content, farmed fish and low-fat fish are more likely to have low mercury content.

For instance, children who are exposed to elevated levels of mercury during pregnancy may develop cognitive problems. Elevated mercury levels can also impair THE immune system and raise your risk of heart attack and high blood pressure. High mercury seafood puts certain people at greater risk, such as youngsters, expectant and nursing mothers, and people who eat fish often. Frequently consume fish, are more at risk from eating seafood with high mercury levels.

Fish that are highest in mercury include:

- Shark
- tuna, especially certain types
- swordfish
- tilefish
- king mackerel

Tuna is considered the most relevant dietary source of mercury in the world. The body absorbs mercury more readily from raw tuna than cooked tuna, thus it is recommended to cook Tuna very well to reduce risk of mercury accumulation

Seafood that's low in mercury tends to be smaller animals that are lower on the food chain, including

- trout
- cod
- haddock
- herring
- salmon
- sardines
- shellfish, like oysters and clams

1.4 Microplastic in Seafood:

Furthermore, the marine environment now has an accumulation of microplastic due to human activity.

These tiny plastic fragments, which are less than 0.19 inches (5 mm) in length, are usually the result of land-based human activities including trash production and manufacturing.

Although there is little study in this area, eating seafood that contains microplastics probably has a negative impact on health.

1.5 How to Prepare Fish?

As with other animal product, it's important to make sure to prepare fish at the right temperature. Under the improper circumstances, any animal can harbour bacteria or have parasites.

The easiest ways to make sure fish is safe to consume are to have it fresh or completely frozen. Fish is a tasty way to add protein and healthy fats to the diet. Some of the Hints includes:

- Bake salmon fillets with ginger and lemon
- Make homemade fish fingers
- Try a fish fry
- Sear tuna steaks on the grill
- Add fish to pasta for a Mediterranean meal
- Substitute fish for chicken in a chicken bake