

Research Article

The Fishes of India- A Super Food of the Coming Era Comprehensive Review

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A B S T R A C T

This research paper explores the numerous health benefits associated with the consumption of fish of India. Fish, being a rich source of essential nutrients such as omega-3 fatty acids, high-quality proteins, vitamins, and minerals, has been recognized for its potential positive impact on human health. The paper reviews scientific studies and literature on the subject, examining the effects of fish consumption on cardiovascular health, cognitive function, immune system support, and overall well-being. Additionally, the potential risks and contaminants associated with fish consumption are addressed to provide a balanced perspective. The findings highlight the importance of including fish in a balanced diet for optimal health.

Fish is often considered a superfood due to its exceptional nutritional profile and numerous health benefits. Here are some reasons why fish is often labeled as a superfood. This research paper aims to provide a comprehensive overview of the health benefits associated with the consumption of fish, helping to inform individuals, healthcare professionals and policymakers about the positive impact of including fish in a balanced and nutritious diet.

Keywords: Fishes of India, Health benefits, Superfood

Introduction

Background of the study

Fish are aquatic vertebrates that belong to the class Pisces. They are characterized by gills, fins, and a streamlined body, allowing them to live and move efficiently in water. Fish species are incredibly diverse, ranging from tiny, colorful tropical fish to large, deep-sea species. They play a crucial role in aquatic ecosystems and are a valuable resource for human consumption. In Bengal, particularly in the cultural context of West Bengal in India and Bangladesh, fish is often referred to as the "fruit of the river." This metaphorical expression highlights the significance of fish in the rivers of the region and their cultural and culinary importance. The Ganges Delta, formed by the confluence of several major rivers including the Ganges, Brahmaputra, and

Meghna, provides fertile grounds for diverse aquatic life. The abundance of rivers and water bodies in the region has made fish a staple in the Bengali diet¹. The metaphor "fruit of the river" underscores the idea that, just as fruits are the natural produce of a tree, fish are the natural produce of the river. This cultural metaphor reflects the deep connection between the people of Bengal and the rivers that sustain their lives. In Bengali cuisine, various fish dishes are integral to daily meals, and there is a rich tradition of preparing fish in different ways, including curries, fries, and stews. Fish is also a significant component of Bengali festivals and celebrations. The cultural significance of fish as the "fruit of the river" in Bengal goes beyond its role as a food source. It is intertwined with the identity, traditions, and way of life of the people in the region. India is home to a rich diversity of fish species due to its varied aquatic

ecosystems, including rivers, lakes, ponds, coastal areas, and the marine environment. The country's fish fauna is characterized by a wide range of species with different ecological adaptations².

Definition of superfood

The term "superfood" is not a scientific classification but is commonly used to describe foods that are rich in nutrients and believed to provide health benefits. Superfoods are often packed with vitamins, minerals, antioxidants, and other compounds that are considered beneficial for overall well-being and health. These foods are typically nutrient-dense and may be associated with the prevention of certain diseases or the promotion of good health. It's important to note that while some foods are labeled as "superfoods" due to their nutritional content, there are no specific criteria or official definition for the term. The concept of superfoods is more of a marketing and popular health trend than a scientific designation.

Examples of foods that are often referred to as superfoods include:

- **Berries (blueberries, strawberries, etc.):** Rich in antioxidants, vitamins, and fiber.
- **Leafy greens (kale, spinach, broccoli, etc.):** Excellent sources of vitamins, minerals, and fiber.³
- **Nuts and seeds (chia seeds, flaxseeds, almonds, walnuts, etc.):** High in healthy fats, fiber, and various nutrients.
- **Fish:** Good sources of omega-3 fatty acids, high-quality proteins, and other nutrients.
- **Whole grains (quinoa, oats, brown rice, etc.):** Rich in fiber, vitamins, and minerals.
- **Turmeric:** Contains curcumin, known for its anti-inflammatory properties.
- **Yogurt:** Provides probiotics (beneficial bacteria) for gut health, along with calcium and protein.

It's essential to approach the concept of superfoods with a balanced perspective. While these foods can be part of a healthy diet, no single food can provide all the necessary nutrients for optimal health. A varied and well-rounded diet that includes a mix of different food groups is generally recommended for maintaining good health. Additionally, individual dietary needs may vary, so it's advisable to consult with a healthcare professional or a registered dietitian for personalized nutrition advice⁴.

Rationale for Investigating Fish as a Superfood

The concept of superfoods has gained considerable attention in recent years as researchers and nutritionists seek to identify foods that offer exceptional health benefits. Fish, particularly certain species rich in omega-3 fatty acids, vitamins, and minerals, has emerged as a potential superfood. This article explores the rationale behind

investigating fish as a superfood, highlighting the unique nutritional composition that sets it apart in promoting overall health and well-being. The investigation into fish as a superfood is grounded in its unique nutritional profile and potential health-promoting properties. From omega-3 fatty acids to vitamins and minerals, fish offers a multifaceted approach to enhancing overall well-being. Continued research in this area not only deepens our understanding of the health benefits associated with fish consumption but also provides valuable insights for developing dietary recommendations and interventions to promote optimal health.⁵

Literature Review

Fish is often considered a superfood due to its nutritional profile and the various health benefits it offers. In the context of India, where fish is a dietary staple for many communities, it holds a special place as a nutritious and valuable source of nutrients. Consuming fish, particularly those high in omega-3 fatty acids, has been shown to protect against ischemic heart disease. This association is especially strong for coronary heart disease mortality and sudden cardiac death, which have been found to be, on average, 52% lower in men who eat fish at least once a week compared to men who eat less. The main cardiovascular benefit of fish, despite its potential nutritional value, comes from its high content of omega-3 fatty acids, docosahexaenoic acid (DHA), and eicosapentaenoic acid (EPA); elevated plasma levels of these fatty acids may help predict a significant decrease in sudden cardiac death⁶.

According to a study, those who consume 5.5 g/month of EPA + DHA, or one serving of fatty fish per week, have 50% fewer chances of experiencing primary cardiac arrest than people who don't eat any fish. Omega-3 fatty acid enrichment of membrane phospholipids and the ensuing decrease in the risk of aberrant cardiac electrical conductivity are linked to or responsible for the impact. The anti-platelet and anti-inflammatory effects of these fatty acids, along with a decrease in plasma triglycerides at higher dosages, are likely additional characteristics that may lower the risk for CHD.

Two servings of fish per week are advised by the American Heart Association, especially those high in omega-3 fatty acids (mackerel, herring, sardine, and salmon). c) Clinical investigations in patients with existing ischemic heart disease have corroborated epidemiological research' findings that patients with CHD may benefit most from consuming more fish. A supplement that contained 0.85 g of EPA and DHA daily reduced sudden cardiovascular death by 45% and 30%, respectively, in the GISSI secondary prevention study. Following three and four months of treatment, respectively, there was a decrease in total mortality and sudden death, which is consistent with the

medication's ability to reduce arrhythmia. (Ref: Indian Journal of Medical Specialties, January–June 2011, Vol. 2, No. 1)⁶

Here are some reasons why fish is often referred to as a superfood in India:

Types of Fishes 2.1

New Water Fish

These fish remain in fresh or non-saline water, as the name implies. Approximately 41% of all fishes that we are aware of are found in freshwater, despite the fact that freshwater on Earth is extremely scarce. When it comes to freshwater fish, India is quite abundant. The Northeast and the Western Ghats are India's two primary freshwater fish zones. Catfish, carp, crappie, bluegill or bream, trout, walleye, bass, drum, and others are some of the freshwater fish that are frequently eaten. Thankfully, India has a large supply of several of these.⁷

Fish in Salt Water

As the name implies, this kind of fish thrives in an environment that is rich in salt, or more precisely, one that is basic (pH of about 8.2). The saline oceanic and sea waters are home to over 60% of all known marine organisms. With the Arabian Sea and Indian Ocean on either side, India is home to a remarkable array of saltwater species. India is home to nearly all of the commonly consumed saltwater fish. The most common names include cod, mackerel, pomfret, herring, anchovies, sardines, salmon, tuna, and snapper.

Others⁸

- The list does not solely focus on fish when it comes to edible aquatic species. Other marine creatures that are essential to Indian seafood dishes include prawns, shrimp, lobsters, squids, crabs, clams, and oysters.
- Here are some notable fish species found in India:
- **Freshwater Fish Species:**
- **Rohu (Labeorohita):** A popular freshwater carp found in rivers and lakes across India.
- **Catla (Catlacatla):** Another major carp species, commonly found in rivers and reservoirs.
- **Murrel (Channa sp.):** Includes various snakehead fish species found in freshwater habitats.
- **Hilsa (Tenulosa ilisha):** A significant fish in the rivers of eastern India, especially in the Ganges and Brahmaputra deltas.
- **Mahseer (Tor sp.):** The Golden Mahseer is a large and iconic freshwater fish found in Himalayan rivers.
- **Marine Fish Species:** Indian Mackerel (*Rastrelliger kanagurta*): A commonly consumed marine fish along the Indian coast.

- **Hilsa (Tenulosailisha):** Found in both freshwater and marine environments during different stages of its life cycle.
- **Bombay Duck (Harpadon nehereus):** A small marine fish, popular for its distinctive flavor.
- **Pomfret (Pampus sp.):** Silver and black pomfrets are popular marine food fishes.
- **Kingfish (Scomberomorus commerson):** A pelagic fish found in coastal waters, valued for its taste.
- **Brackish Water Species:**
- **Mud Crab (Scylla serrata):** Commonly found in estuarine and mangrove areas.
- **Prawn (Penaeus monodon):** A commercially important species in brackish water aquaculture.
- **Mullet (Liza sp.):** Brackish water fish often found in estuaries and lagoons.
- **Mangrove Red Snapper (Lutjanus argentimaculatus):** Inhabits mangrove areas and estuaries.
- **Endangered and Threatened Species:**
- **Ganges River Dolphin (Platanista gangetica):** An iconic freshwater mammal found in the Ganges and Brahmaputra rivers.
- **Indian Sawfish (Pristis pristis):** Critically endangered elasmobranch species.
- **Invasive Species:** Tilapia (*Tilapia sp.*): Introduced for aquaculture, tilapia has become invasive in some water bodies.
- **Important Game Fish:**
- **Barramundi (Latescalcarifer):** A prized game fish found in coastal waters.
- **Yellowfin Tuna (Thunnus albacares):** Sought after by sport and commercial fishermen.
- This list is not exhaustive, and India's diverse aquatic environments support many more fish species. Additionally, ongoing research may reveal new species and contribute to the understanding of the country's ichthyofauna. Conservation efforts are crucial to maintaining the biodiversity of Indian fishes and ensuring sustainable fisheries⁹.
- Cod liver oil capsules are typically not vegetarian. Cod liver oil is derived from the liver of codfish, and the oil is extracted to produce supplements that are rich in omega-3 fatty acids, vitamin D, and vitamin A. Since it is derived from fish, cod liver oil capsules fall under the category of animal-derived products and are not considered vegetarian. For individuals following vegetarian or vegan diets who wish to supplement their intake of omega-3 fatty acids, vitamin D, or other nutrients, plant-based alternatives such as algae oil supplements may be more suitable. Algae oil is derived from certain types of algae and provides a plant-based source of omega-3 fatty acids, similar to those found in fish¹⁰.

Indian fish market growth

- This broad category of food, which ranges from farmed prawns to wild-caught mackerel, can have a wide range of negative effects on the environment, including high carbon emissions, overfishing, antibiotic pollution, and slaughter bycatch. Many people who want to eat more sustainably opt out completely and stick to vegetarian or vegan options instead. However, some fish can be both a healthy food source and have a low carbon footprint.
- Additionally, choosing a more sustainable option can have a significant impact if you plan to eat fish. "The seafood category is really diverse," says Jessica Gephart, an assistant professor of environmental science at the American University in Washington, DC. It comprises over 2,500 distinct species that are produced by capture and farmed fisheries.¹¹
- There, we're actually discussing quite different manufacturing systems. Some "really great opportunities for finding really sustainable options within that" are included in this, according to her. Outlook for the Indian Fish Market The Expert Market Research (EMR) analysis projects that the fish market in India will expand at a compound annual growth rate (CAGR) of 15.7% from 2024 to 2032. By 2032, the market is anticipated to have grown greatly due to changes in lifestyle and growing knowledge of fish as a nutritious cuisine¹².

Indian Fish Market Overview

- In 2022, the size of the Indian fish market was 19.0 million tons. According to IMARC Group's forecast, the market would increase at a compound annual growth rate (CAGR) of 8.81% from 2023 to 2028, reaching 31.7 million tons. Some of the main factors propelling the market include growing consumer awareness of the nutritional advantages of aquatic cuisine, ongoing technological developments in aquaculture, active government initiatives supporting sustainable fisheries practices, and changing consumer preferences toward diets high in protein.Table1.

Table 1.Indian Fish Market Overview

Report Attribute	Key Statistics
Base Year	2022
Forecast Years	2023-2028
Historical Years	2017-2022
Market Size in 2022	19.0 Million Tons
Market Forecast in 2028	31.7 Million Tons
Market Growth Rate (2023-2028)	8.81%

Fish are vertebrates with cold blood that mostly live in freshwater and marine habitats. With thousands of species, fish are a biologically varied group distinguished by their gills for breathing, scales covering their bodies, and fins for mobility. Furthermore, fish are a great source of proteins, different vitamins and minerals, and omega-3 fatty acids, among other vital nutrients. Fish are taken from their natural habitats in capture fisheries using a variety of methods, such as nets, lines, and traps¹³.

Aquaculture, on the other hand, is the regulated breeding, raising, and harvesting of fish in specific locations, such as fish farms. Here, factors like feed, temperature, and water quality can be changed to maximize health and growth. From direct human consumption to applications in pharmaceuticals and pet supplies, the capture and breeding processes seek to meet a range of commercial demands. The growing consumer awareness of the nutritional advantages of aquatic cuisine is the main factor propelling the Indian industry. Accordingly, ongoing developments in aquaculture technology are increasing production capacity, which is driving the market. Furthermore, vigorous government programs encouraging sustainable fishing methods are playing a major role in stimulating growth.

Furthermore, the development of cold-chain logistics networks is enabling wider product distribution, which lowers waste and raises investment in high-end products. In addition, the nation's diverse cuisine is driving up demand for a variety of aquatic species, which is opening up profitable chances.

Additionally, the industry is benefiting from a shift in consumer tastes toward meals high in protein due to health-consciousness. Increases in disposable income, better post-harvest management techniques that extend shelf life, the start of quality certification programs that boost consumer confidence, and government-supported educational initiatives that emphasize the significance of ethical fishing methods are some of the additional factors driving the market¹⁴.

Indian Fish Market Trends/Drivers:

Rising export opportunities

The growing export potential is another element having a big influence on the Indian market. India has the potential to be a major exporter of aquatic products because of its extensive inland water resources and more than 3,000 kilometers of coastline.

By enforcing strict quality standards and adhering to international rules, the nation has already begun to capitalize on this edge, attracting overseas markets with its aquatic products. In this sense, government incentives for export-

oriented manufacturing and partnerships with nations that consume a lot of seafood are serving as catalysts.

In addition to diversifying the market, the growing emphasis on exports brings in a significant amount of foreign investment, which serves as a powerful economic accelerator. This is a key factor in the expansion of the market as a whole since it multiplies the impact on other industries like shipping and logistics. Fig. 2: Nutrient composition in the fishes of India—Global superfood of this era.¹⁵

An enhanced focus on adaptation to climate change

The ability of the aquatic industry to adapt to climate change is one of the key elements propelling the Indian market. The Indian market is demonstrating resilience by implementing cutting-edge, climate-resilient farming practices as global temperatures increase and aquatic habitats grow more fragile.

These techniques provide a consistent supply of a variety of aquatic species in addition to providing protection against environmental threats. These adaptation strategies, which range from breeding species that can withstand high temperatures to establishing buffer zones against flooding, are enabling the sector to not just endure but flourish.

Investments in climate-resilient aquaculture research and technology are creating new opportunities for sustainable growth and drawing in both domestic and foreign partners. This element is crucial in securing the industry's future and provides a competitive advantage in the worldwide market, which propels further market growth. Fig 1: Indian Fish Market Trends/Drivers¹⁷.

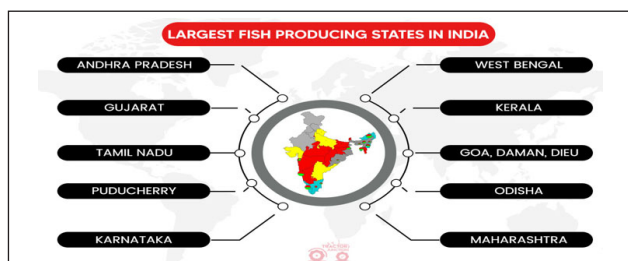


Figure 1. Indian Fish Market Trends/Drivers

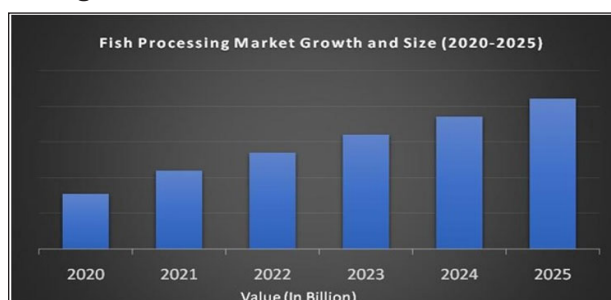


Figure 2. Nutrients composition in the fishes of India
-Global super food of this era

Few Indian hidden gem fish every one should eat in daily diet:-

Rawas (Indian Salmon)



Figure 3. Rawas



Figure 4. Indian Salmon

Protein per 100 grams: 25 to 26 grams

Omega 3: 2260 mg

Mercury: Less than 0.09 ppm (Low Level)

One of the most widely consumed edible fish is Indian salmon. In India, rawas, as it is known, is a common fish that is prized for its mild flavor and pink to orange flesh. The rawas is an oily fish, meaning that it has oil in practically every part of its body, including its tissues and abdominal cavities. Fig 3: Rawas. An Indian salmon fillet is a boneless piece of meat that has about 30% oil in it. Omega 3, vitamin A, and vitamin D are abundant in this oil. Salmon may contain additional pollutants, such as PCBs, even though its mercury content is minimal. Thus, limit your weekly intake of salmon to 170 grams. Fig. 4: Indian Salmon.

Katla (Indian Carp or Bengal Carp)¹⁸



Figure 5. Katla

Protein per 100 grams: 23 grams

Omega 3: 902 mg

Mercury: 0.09 to 0.29 ppm (Moderate Level)

A common freshwater fish in the lakes and rivers of Assam and North India is the katla. A fully grown fish can weigh up to 2 kg on average. One of the most popular oily fish is katla. Both necessary fatty acids and protein are abundant in it. It has bones; if you don't like bones, ask for the stomach part. This fish is bigger; the head is bigger and thicker than ROHU. Best katla is when you fry; the size will increase. Katla is costlier than rohu. Fig 5: Katla.

Rohu (Roho or Carpo Fish)



Figure 6.Rohu

Protein per 100 grams: 17 grams

Total Unsaturated Fat: 1.4 grams

Mercury: 0.09 to 0.29 ppm (Moderate Level)

Rohu belongs to the Carp family as well. Both Northern and Central India have a large supply of this freshwater fish. The fish is frequently eaten for its meat because it may weigh up to two kilograms on average. But because it's an oily fish, it also has a lot of omega fatty acids. Rohu has smaller and more bones compared to katla. Fig. 6: Rohu.

Bangda (Indian Mackerel)



Figure 7.Bangda

Protein per 100 grams: 17 grams

Omega 3: 2646 mg

Mercury: Less than 0.09 ppm (Low Level)

One of the main fish in India is Indian mackerel, or bangda as it is commonly known. The Indian Ocean and its neighboring seas are home to a large population of this saltwater fish. Because it is an oily fish, mackerel is a good source of both protein and Omega 3. Fig 7: Bangda.

Surmai (Seer Fish / King Mackerel / King Fish)



Figure 8 & 9.Surmai

Protein per 100 grams: 26 grams

Omega 3: 423 mg

Mercury: More than 0.7 ppm (Highest Level)

In India, surmai is one of the most expensive and well-liked fish. In South and Central India, it is more well-liked. Surmai is considered a delicacy in Kerala, Tamil Nadu, Andhra Pradesh, and other states. Surmai, often known as the "King Mackerel" or "Indo-Pacific Mackerel," is a variety of mackerel. Fig. 8 and 9: Surmai.

Paplet (Pomfret / Indian Butter Fish)



Figure 10.Paplet

Protein per 100 grams: 18 grams

Omega 3: 1230 mg

Mercury: Less than 0.09 ppm (Low Level)

Once more, one of India's most unique fish is the puffer. A common species of butterfish in South Asia, particularly the Indian Ocean, is the pomfret. The white meat of the non-oily pomfret fish is incredibly tasty. The two most often sold fish in India are black pomfret and silver or white pomfret. Its solitary bone is soft. The ideal size in a kilogram is 6–8 pieces. Fig10: Paplet.

Hilsa (Herring / Indian Shad / Ilish)

Protein per 100 grams: 21 grams

Omega 3: 2418 mg

Mercury: Less than 0.09 ppm (Low Level)



Figure 11. Hilsa

Who hasn't heard about Hilsa? It is the most popular Bengali fish (the national fish of Bangladesh, Padda Nadir, the best hilsa, pronounced as illsh, is from the river Padda in Bangladesh and is very popular in Odisha, West Bengal, Assam, Andhra Pradesh, Gujarat, etc.). It is a delicacy not just in India but also all over South Asia. Bigger hilsa are costly and tasty, 1 kg. It has very small and very thin bones. Fig 11: Hilsa.

Bhekta (Barramundi/Asian Seabass)

This fish is also known as Bengal bhetki in Bengali. The English name for it is barramundi or Asian sea bass. This fish has a single long bone only. The fish's flesh is pearly pink, has big, hard flakes, and is easy to cook because it has less fat than its other partners. Barramundi is a favorite among those who wish to take on the role of chef because it is enjoyable to prepare and doesn't emit a strong smell. Fig. 12 and 13: Bhekta¹⁹.

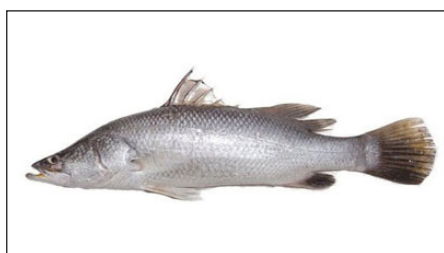


Figure 12 & 13. Bhekta

Health Benefits of Consumption of Indian Fishes and It Helps in Boosting Human Immune System

Immune System 3.1

What is the immune system? The immune system is our body's self-guarding system against infections. Our

immune system counters attacking germs/viruses to keep our body disease-free. The immune system is like a fully forced defense system that helps outside invaders of new bacteria entering in our body & also prevents the internal bacterial growth present in our body. Our immune system is essential for our survival; without a good immune system, our body will be exposed to different kinds of bacteria, viruses, parasites, and more, which will enter our body and cause several diseases. Our good immune system keeps our body healthy as we are encircled at all times with pathogens (pathogens are bacteria, viruses, or microorganisms that can cause disease). Immune System—what is it made of? Different cells & organs work together to protect the body. White blood cells, also called leukocytes, play an important role in building the immune system. Some types of white blood cells are called phagocytes, which chew up invading microorganisms, bacteria, and viruses. Other types are lymphocytes, which help the body remember the invaders (bacteria, virus) & destroy them. Lymphocytes are B cells, T cells, & natural killer cells. White blood cells are made in your bone marrow, & the cells move through blood & tissue throughout our body, searching for foreign invaders such as bacteria, viruses, parasites, etc., & after they find them, the cells attack them. The inner & outer surfaces of the body, like skin and mucous membranes, are the first barrier against pathogens (germs) and are a kind of mechanical protective wall. The cough & sneeze reflex can also help to remove pathogens (germs). The white blood cells are stored in different places in our body, which are referred to as lymphoid organs. The different parts of the immune system are a) bone marrow. Found in the center of bones. Bone marrows are spongy tissue found inside our bones. It produces the red blood cells our body needs to carry oxygen, the white blood cells we use to fight infection, and the platelets, or thrombocytes, which are small, colorless cell fragments

in our blood that form clots and stop or prevent bleeding. b) Thymus A gland situated above the heart & behind the breastbone one) is called a lymphoid organ. It produces white blood cells. c) Spleen An organ that filters the blood. It is in the upper left of the abdomen. It also makes disease-fighting components of the immune system (including antibodies & lymphocytes). d) Lymph Nodes & Vessels: small glands positioned throughout the bodies (if the immune system is the police force, lymph nodes are the police station). The lymph nodes are located strategically throughout our body, like tonsils, adenoids in the neck, and Peyer's patch in the intestine. Lymph nodes tend to be most prevalent in areas near body openings, such as the digestive tract & genital region, because this is where pathogens enter our bodies. e) Antibodies Also known as an immunoglobulin, it is a large, Y-shaped protein produced mainly by plasma cells (white blood cells) that is used by the

immune system to neutralize pathogens such as pathogenic bacteria & viruses. f) Skin: Sometimes skin is described as the largest organ of the immune system because it covers the entire body. In short, if our immune system in our body is like a defense system of a country, its different parts are like the military, air forces, navy, etc.²⁰

Health benefits of consumption of fish in daily diet

A fantastic source of heart-healthy lean protein is fish. Eating fish once a week can reduce your risk of heart attack by nearly one-third. This is due to the fact that it includes heart-healthy omega-3 fatty acids, which lower triglyceride levels, improve brain function, and help reduce inflammation throughout the body. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are found in oily fish. Omega-3 fatty acids may also be crucial for the synthesis of substances that control immunity and shield the body from harm caused by overreaction to infections.

Fish is a great source of omega-3 fatty acids, also referred to as long-chain omega-3s, EPA, and DHA. However, that doesn't imply there aren't drawbacks to eating fish. High concentrations of mercury, a hazardous pollutant that can harm the neurological system, are found in many fish species. Mercury levels in our lakes, streams, and oceans have only increased due to pollution; fish ingest this mercury and transform it into the poison known as methyl mercury.

Smaller fish, lower on the food chain, are better to eat since high-ranking species can compound their mercury levels by consuming other contaminated fish. You may believe that farmed fish are safer, but they are also given the same growth hormones, antibiotics, and other substances that are not present in their natural environment, so you should stay away from them.

Since their growing neural systems are more susceptible to the effects of mercury, babies and young children are the main target of worry when it comes to fish and mercury. For this reason, it is recommended that pregnant and lactating women exercise particular caution when selecting the kinds of fish they consume. Fish found in nearby ponds, rivers, and lakes, such as salmon, rohu, katla, hilsa, surmai (kingfish), etc., are generally advised to be avoided by experts.²¹

The health benefits of fish are

The good fat

Omega-3 fatty acids, the healthy fat, are abundant in fish. Pregnant women are particularly advised to consume these fatty acids because they are crucial for the healthy operation of the brain and vision.

Healthy heart

Fish is very recommended for heart health because it is free of saturated fats. If you routinely eat fish instead of other protein sources like mutton and lamb, you can reduce

cholesterol, one of the main enemies of heart health. The greatest way to prevent cardiovascular illnesses is to include fish in your diet.

The best source of vitamin

Vitamin D, which is found naturally in fish, aids in the body's absorption of various other nutrients and promotes general health.

Fight depression

Omega-3 fatty acids, DHA, and vitamin D are all components of fish that can help prevent mental health problems. You may combat depression and mood swings by eating fish, which is a natural antidepressant. Therefore, eating fish can help you stay happy and healthier.

Low risk of major diseases and high immunity booster

Regular consumption of fish can help prevent autoimmune conditions, including diabetes and rheumatoid arthritis. Fish is a one-stop shop for so many essential nutrients that it can help prevent a number of serious illnesses and keep your body in a healthy balance.

In addition to these advantages, eating fish increases your metabolism, reduces inflammation, enhances your sleep, and improves the quality of your skin and concentration.²²

The Role of Fish in Enhancing the Human Immune System 3.3

The human immune system plays a vital role in defending the body against infections and diseases. Various factors, including diet, contribute significantly to the overall strength and efficiency of the immune system. One such dietary component that has gained recognition for its immune-boosting properties is fish. Rich in essential nutrients and omega-3 fatty acids, fish can play a crucial role in enhancing the immune response and promoting overall health.

- **Omega-3 Fatty Acids:** Fish, especially fatty fish like salmon, mackerel, and tuna, are abundant sources of omega-3 fatty acids, namely eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These fatty acids are known to have anti-inflammatory properties, which can help regulate the immune system's response to pathogens²³.
- **Inflammation Regulation:** Omega-3 fatty acids have been shown to modulate inflammation in the body. Chronic inflammation is associated with various health issues and can compromise the immune system. By reducing inflammation, omega-3 fatty acids contribute to a balanced immune response, allowing the body to better combat infections.
- **Immune Cell Function:** Omega-3 fatty acids play a role in supporting the function of immune cells, such as white blood cells. These cells are essential for identifying and

eliminating pathogens, and the optimal functioning of immune cells is crucial for an effective immune response. The incorporation of omega-3 fatty acids from fish into the diet can support the integrity and efficiency of immune cell membranes.

- **Vitamins and Minerals:** In addition to omega-3 fatty acids, fish is a rich source of various vitamins and minerals that are important for immune system function.
- **Vitamin D:** Many fish species are natural sources of vitamin D, a nutrient that plays a key role in immune system regulation. Vitamin D has been linked to the modulation of immune responses and the prevention of autoimmune diseases.
- **Selenium and Zinc:** Fish, particularly shellfish, are good sources of selenium and zinc—essential minerals that contribute to the proper functioning of the immune system. These minerals are involved in the activation of enzymes and proteins that support immune cell activity.
- Incorporating fish into your diet can be a delicious and nutritious way to support your immune system. The combination of omega-3 fatty acids, vitamins, and minerals found in fish contributes to a well-rounded approach to immune health. However, it's essential to maintain a balanced diet and adopt a healthy lifestyle to ensure overall well-being and a robust immune system. As always, individuals with specific dietary concerns or medical conditions should consult with healthcare professionals for personalized advice²⁴.

Recommendations And Guidelines Of Eating Indian Fish

Dietary Guidelines for Fish Consumption

Dietary guidelines for the consumption of Indian fish, offering insights into the nutritional benefits, recommended servings, and sustainable practices for ensuring a balanced and health-promoting diet.

Choose a Variety of Fish

Incorporate a variety of fish species into your diet to benefit from diverse nutrients.

Include both freshwater and marine fish to obtain a broad spectrum of essential vitamins, minerals, and omega-3 fatty acids.

Mindful Serving Sizes

Consume fish in moderate and appropriate serving sizes to avoid excessive intake of mercury and other contaminants.

Follow recommended guidelines for specific fish species, especially for pregnant women and children, to ensure optimal health without compromising safety.

Opt for Lean and Fatty Fish

Include both lean fish (e.g., catla, rohu) and fatty fish (e.g., mackerel, sardines) in your diet.

Lean fish are rich in protein and low in fat, while fatty fish provide essential omega-3 fatty acids, promoting heart and brain health.

Balanced Preparation Methods

Choose healthy cooking methods such as grilling, baking, or steaming to preserve the nutritional content of fish.

Limit deep-frying and excessive use of oil, which can add unnecessary calories and compromise the health benefits of fish.

Mind Mercury Levels

Be aware of mercury levels in certain predatory fish like shark and king mackerel.

Limit the consumption of high-mercury fish, especially for pregnant women, nursing mothers, and young children, to minimize potential health risks.

Incorporate Traditional Preparations

Explore traditional Indian recipes that showcase the flavors of fish along with local spices and herbs.

Traditional preparations often emphasize the use of fresh ingredients and minimal processing, enhancing the nutritional value of the dish.

Sustainable Fishing Practices

Support sustainable and responsible fishing practices to preserve the marine ecosystem and maintain fish populations.

Choose fish that are caught or farmed using environmentally friendly methods, promoting long-term ecological balance.

Consider Cultural and Regional Variations

Embrace the cultural diversity of Indian cuisine by incorporating regional variations in fish preparations.

Explore local recipes that highlight the unique flavors and culinary traditions of different states and communities²⁵.

Choosing the Right Types of Fish from the Market

How to identify the best quality fish when you buy from the market

- **The fish texture should be firm, and the fish should not look dull:** Touching the fish should cause its flesh to bounce back. The skin should not appear lifeless because it has a natural glow. The skin's surface must be taut, and the scales may be firmly adhered. Old or rotting fish may have cracked skin or loose scales. Fig. 14: Choosing the Right Types of Fish from the Market.

- **Soothing smell:** Fresh fish should have a subtle fragrance rather than be odorous. Fish with a strong, fishy, or sour scent should be avoided. The fish has a distinct scent that is unique to the river or sea where it was captured. It's comfortable and natural. Trimethylamine is an organic chemical generated from rotting fish that gives it a strong, harsh smell when it is old or ruined.
 - **Examine the gills:** they should be either crimson or brilliant pink in color. Additionally, they should be somewhat damp rather than dried or slimy. (Sometimes they pour blood in the gill to look fresh; check for that.). Fig 15: Examine the gills.
 - **Eyes never lie:** one of the finest methods for determining whether your fish is fresh. The fish's eyes can reveal a lot about how fresh it is. The eyes ought to be clear, bright, and protruding. There should not be any cloudiness. The fish may appear elderly even if its eyes are set within its skull. Fig. 14: Choosing the Right Types of Fish from the Market.²⁶
- Locate the fish's anus and cut it out in a "V" or notch shape after spreading the body open and removing all of the entrails.
 - The kidney is attached to the backbone of certain fish. Using your fingernail or a spoon, scrape it out to remove it.
 - Wash the skin after using a strong stream of water to rinse the cavity out. To avoid a harsh, greasy taste, the black tissue lining the stomach cavity of some fish can be scraped out.
 - Remove the head if you like; trout are often cooked with the head on. Remove the gills if you are eating the head, which (the head) is highly beneficial.
 - Immediately clean your fish washing table, gather the scales, heads, and guts, and dispose of them appropriately.
 - Your clean fish is now ready to be cooked²⁷.

Conclusion

Summary of Findings 5.1

"Fishes of India: A Superfood of the Coming Era" presents a comprehensive overview of the nutritional, health, and sustainability aspects of Indian fishes. As the world searches for sustainable and nutrient-rich food sources, the rich diversity of Indian fishes emerges as a promising solution to nourish both the present and future generations. Embracing these aquatic treasures not only offers a delectable culinary experience but also aligns with the growing need for responsible and mindful consumption in the coming era. Incorporating Indian fish into your diet can be a flavorful and nutritious way to promote overall health. By following these dietary guidelines, individuals can enjoy the diverse benefits of Indian fish while ensuring responsible and sustainable consumption. Whether exploring traditional recipes or trying new culinary creations, the inclusion of fish in a well-balanced diet contributes to a wholesome and satisfying dining experience.

In the pursuit of a wholesome and balanced diet, the choice between red meat and alternative protein sources plays a pivotal role in shaping our nutritional intake. Fish, with its myriad health benefits, emerges as a superior alternative to red meat. This article explores the reasons why fish stands out as a nutrient-rich and heart-healthy option, offering a compelling case for its inclusion in a well-rounded diet.

Reducing saturated fat intake is a key dietary recommendation for maintaining cardiovascular health. Fish typically contains lower levels of saturated fat compared to certain cuts of red meat and other meats.

Choosing fish over meat can contribute to a more heart-friendly lipid profile.

It's important to note that individual dietary choices are highly personal, and what works for one person may not

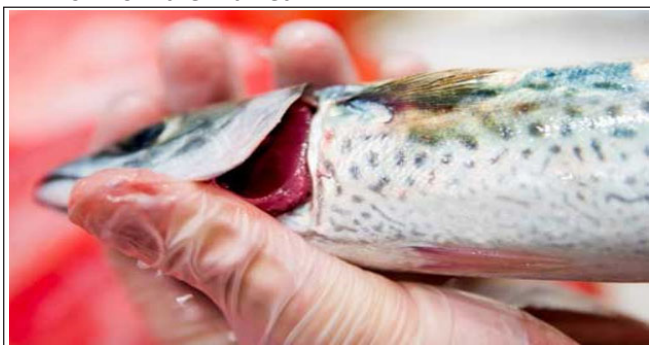


Figure 14. Choosing the Right Types of Fish from market



Figure 15. Examine the gills

How to clean fish: Place the fish on the cutting board or table to start. Move the knife blade up along the fish's belly, cutting to the head, after inserting the tip into the belly close to the anal entrance.

Keep the knife blade shallow so you don't puncture the intestines. Scrap/remove the scales thoroughly if you are cutting KATLA, ROHU, or HILSA.

work for another. If someone chooses to include fish in their vegetarian diet, it's crucial to prioritize sustainably sourced options and be mindful of the potential environmental and ethical considerations associated with fishing practices. Additionally, consulting with a healthcare professional or a registered dietitian can help ensure that nutritional needs are adequately met.

As we navigate the challenges of modern living and seek sustainable and nutrient-rich dietary choices, the spotlight turns to the culinary treasures that lie within the waters surrounding India. Indian fish, with its diverse species and rich nutritional profile, emerges as the superfood of the new era. This article explores the reasons why Indian fish stands out as a powerhouse of health and a culinary delight, poised to shape the future of nutrition. Indian fish, with its nutritional richness, cultural significance, and potential for sustainable sourcing, stands poised to be the superfood of the new era. As we navigate a world where dietary choices impact not only our health but also the planet, Indian fish emerges as a culinary and nutritional marvel, promising a sustainable and delectable future for nutrition. Embracing the bounty of Indian waters is not just a gastronomic choice; it's a step towards shaping a healthier, more sustainable world for generations to come.

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