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Review Article

Health Benefits and Food Security Potential of *Labeo rohita*: A Review

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Abstract

Fish plays a crucial role in human nutrition by providing high-quality protein, essential fatty acids, vitamins, and minerals required for growth and health maintenance. Among freshwater fish species, *Labeo rohita* (Rohu) is one of the most widely cultured and consumed fishes in South Asia. Its popularity is not only due to its economic importance and consumer preference but also because of its significant nutritional and health-promoting properties. The species provides highly digestible protein, beneficial polyunsaturated fatty acids, and essential micronutrients that support various physiological functions. Regular consumption of Rohu has been associated with improved cardiovascular health, enhanced cognitive development, strengthened immune responses, and better overall nutritional status. Beyond individual health benefits, Rohu contributes substantially to food and nutritional security through its affordability, availability, and suitability for large-scale aquaculture production. In many developing countries, where protein deficiency and micronutrient malnutrition remain public health concerns, Rohu serves as an accessible and sustainable source of nutrient-rich food. This review examines the health benefits associated with Rohu consumption and highlights its role in promoting nutritional security and sustainable food systems.

Keywords: *Labeo rohita*, Rohu, health benefits, food security, nutrition, aquaculture, protein, omega-3 fatty acids.

1. Introduction

Fish has long been recognized as a vital component of healthy diets because it supplies a wide range of nutrients required for normal growth, development, and physiological functioning. Increasing awareness regarding the relationship between nutrition and health has encouraged greater emphasis on fish consumption as part of balanced dietary practices. Among freshwater fish species, *Labeo rohita* occupies a unique position owing to its widespread availability, consumer acceptance, and nutritional significance. It is one of the principal Indian major carps and contributes substantially to freshwater aquaculture production across South Asia [1].

The importance of Rohu extends beyond its commercial value. Scientific studies have demonstrated that the species contains high-quality protein, essential fatty acids, vitamins, and minerals that collectively support human health [15]. Unlike many animal-derived foods that are rich in saturated fats, Rohu provides nutritionally beneficial lipids that contribute positively to cardiovascular and neurological functions. The fish is also highly digestible, making it suitable for individuals of different age groups and physiological conditions [11].

In addition to its health benefits, Rohu plays an important role in addressing food and nutritional security challenges. Rapid population growth, increasing demand for animal protein, and persistent malnutrition in many developing countries have intensified the need for affordable and sustainable food resources. The widespread culture and consumption of Rohu make it an important contributor to public health and nutrition. Therefore, understanding its health-promoting properties and food security potential is essential for maximizing its benefits in human diets.

2. Health Benefits of Rohu Consumption

The nutritional composition of *Labeo rohita* provides a variety of health benefits that support overall well-being and physiological functioning. The combination of proteins, essential fatty acids, vitamins, and minerals makes Rohu a nutritionally balanced food capable of meeting multiple dietary requirements. As nutrition-related disorders continue to increase globally, the inclusion of nutrient-rich fish such as Rohu in regular diets has become increasingly important [5].

One of the major advantages of Rohu consumption is its contribution to cardiovascular health. The fish contains beneficial polyunsaturated fatty acids that help maintain healthy blood lipid profiles and support normal heart function. Regular fish consumption has been associated with reduced risk factors for cardiovascular disease and improved circulatory health. The relatively low saturated fat content of Rohu further enhances its suitability for heart-healthy diets [9].

Rohu also contributes to neurological development and cognitive function. Essential fatty acids present in fish tissues are important structural components of the brain and nervous system [4]. Adequate intake of these nutrients supports memory, learning ability, and normal neurological development. In addition, the vitamins and minerals present in Rohu contribute to immune regulation, antioxidant defense, and metabolic efficiency [12]. The combined action of these nutrients promotes overall health and may reduce susceptibility to various nutritional disorders. Consequently, Rohu represents a valuable dietary component capable of supporting both physical and mental well-being.

3. Role of Rohu Protein in Human Nutrition

Protein is a fundamental nutrient required for growth, tissue repair, enzyme synthesis, hormone production, and immune function. The protein present in *Labeo rohita* contributes significantly to its nutritional importance and plays a central role in maintaining human health. Rohu contains

high-quality protein with a balanced amino acid composition, making it an effective source of essential nutrients required for normal physiological functioning [20].

The amino acids present in Rohu are involved in the formation and maintenance of muscles, organs, and other body tissues. Essential amino acids such as lysine, methionine, leucine, and threonine support growth and metabolic activities while also participating in protein synthesis. Since these amino acids cannot be produced in sufficient quantities by the human body, their dietary intake is necessary. The consumption of Rohu therefore contributes to meeting daily protein requirements and maintaining positive nitrogen balance [18].

An important characteristic of fish protein is its high digestibility. The relatively low connective tissue content of fish muscle allows digestive enzymes to break down proteins efficiently, resulting in improved nutrient absorption. This property makes Rohu particularly beneficial for children, elderly individuals, pregnant women, and people recovering from illness. In regions where protein-energy malnutrition remains a public health concern, Rohu provides an affordable and accessible source of quality protein. Regular consumption can therefore contribute to improved nutritional status, enhanced growth, and better overall health outcomes [8].

4. Importance of Rohu Lipids and Micronutrients in Disease Prevention

The lipids and micronutrients present in *Labeo rohita* contribute significantly to disease prevention and health maintenance. Although Rohu contains only moderate quantities of fat, its lipid fraction includes nutritionally important fatty acids that support numerous physiological functions. Polyunsaturated fatty acids, particularly omega-3 fatty acids, have attracted considerable attention because of their role in reducing the risk of chronic diseases [13].

Omega-3 fatty acids are known to support cardiovascular health by helping maintain normal blood lipid levels and reducing inflammatory responses within the body. These fatty acids also contribute to brain development, neurological function, and visual health. Their presence in Rohu enhances the nutritional value of the species and supports its role as a health-promoting food. In addition, fish-derived fatty acids may contribute to improved immune responses and cellular function [17,14].

Micronutrients found in Rohu further strengthen its disease-preventive potential. Minerals such as iron, zinc, calcium, and phosphorus support blood formation, immune function, skeletal health, and metabolic regulation. Vitamins A, D, E, and K contribute to vision, bone development, antioxidant protection, and normal physiological functioning [3]. The synergistic action of these nutrients supports overall health and helps prevent deficiencies that may lead to chronic health problems. Consequently, regular consumption of Rohu can contribute to the maintenance of nutritional balance and reduction of disease risk.

5. Rohu and Food Security

Food security refers to the availability, accessibility, and utilization of sufficient nutritious food to meet dietary needs and support healthy living. *Labeo rohita* plays an important role in food security because it provides a reliable source of high-quality nutrition for large populations. Its extensive cultivation and widespread distribution have made it one of the most accessible freshwater fish species in South Asia [16].

The affordability of Rohu is a major factor contributing to its importance in food security. Compared with many terrestrial animal protein sources, Rohu is often available at lower cost while still providing substantial nutritional benefits. This affordability allows economically disadvantaged populations to access nutrient-rich food and improve dietary quality. In addition to

protein, Rohu supplies essential fatty acids, vitamins, and minerals that contribute to overall nutritional adequacy [6].

The role of Rohu in combating malnutrition is particularly significant in developing countries where deficiencies of protein and micronutrients remain prevalent. The inclusion of fish in regular diets can improve nutrient intake and support healthy growth and development. Furthermore, the popularity of Rohu among consumers ensures consistent demand and encourages continued aquaculture production. By providing a nutritious and affordable food source, Rohu contributes substantially to food security and public health [6].

6. Aquaculture Production and Sustainable Nutrition

The expansion of aquaculture has transformed fish production and increased the availability of nutrient-rich foods for growing populations. *Labeo rohita* is one of the most important freshwater aquaculture species and contributes significantly to sustainable food production systems. Its rapid growth, adaptability to different culture environments, and high market demand have made it a preferred species for farmers throughout South Asia [10].

Rohu is commonly cultured in composite fish farming systems where multiple species occupy different ecological niches within the same pond. This practice improves resource utilization and enhances overall productivity. Advances in breeding technologies, feed development, and pond management have further increased production efficiency and ensured a stable supply of fish throughout the year [7]. Such developments are essential for meeting the rising demand for animal protein in developing countries.

From a nutritional perspective, aquaculture production of Rohu supports sustainable nutrition by providing a continuous source of high-quality food. Compared with many livestock production systems, fish farming often requires fewer natural resources and can generate substantial nutritional output. The widespread cultivation of Rohu therefore contributes not only to economic development but also to public health objectives related to nutrition and food security. Sustainable management of aquaculture resources will continue to strengthen the role of Rohu in supporting future nutritional needs.

7. Effect of Processing and Cooking on Nutritional Benefits

According to Agyei-Mensah et al., [2], the processing and cooking are important steps that influence the nutritional quality of fish before consumption. While these practices improve safety, flavor, and storage stability, they may also affect nutrient composition. The extent of these changes depends on factors such as cooking temperature, duration, and processing method. Understanding these effects is important for maximizing the health benefits derived from Rohu consumption.

Cooking generally enhances protein digestibility by altering protein structures and making them more accessible to digestive enzymes. At the same time, excessive heating may reduce the concentration of certain heat-sensitive vitamins and promote oxidation of polyunsaturated fatty acids [19]. Moisture loss during cooking can increase the relative concentration of proteins and minerals in the edible portion of the fish.

Different cooking methods influence nutrient retention differently. Steaming and baking are often considered favorable because they preserve a greater proportion of beneficial fatty acids and vitamins. In contrast, deep frying may increase fat content and alter the original fatty acid profile through oil absorption. Preservation methods such as freezing and chilling help maintain nutritional quality when properly managed. Despite these changes, Rohu remains a highly nutritious food after processing and continues to provide valuable

nutrients that support human health and well-being.

Conclusion

Labeo rohita is a nutritionally valuable freshwater fish that offers numerous health benefits and plays a significant role in food and nutritional security. Its high-quality protein, beneficial fatty acids, vitamins, and minerals support growth, tissue maintenance, cardiovascular health, cognitive development, and immune function. The excellent digestibility and balanced nutrient composition of Rohu make it suitable for individuals across different age groups and nutritional needs.

Beyond its contribution to individual health, Rohu serves as an affordable and accessible source of nutrient-rich food for millions of people. Its extensive aquaculture production ensures year-round availability and strengthens efforts to address protein deficiency and micronutrient malnutrition. The species also contributes to sustainable nutrition by providing high nutritional output through efficient aquaculture systems. Although processing and cooking may influence certain nutrients, Rohu retains substantial nutritional value and remains an important component of healthy diets.

Considering its nutritional benefits, economic importance, and contribution to food security, *Labeo rohita* represents a valuable resource for promoting public health and supporting sustainable food systems. Continued research and responsible aquaculture practices will further enhance its role in meeting future nutritional demands.

Disclosure statements

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