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Address for correspondence:

Yogesh V. Bidwe
Department of Zoology, Dr. Rafiq Zakaria College for Women, Navkhanda, Jubilee Park, Chhatrapati Sambhajnagar, (MS), India
Email:
yogeshbidwe007@gmail.com

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Review on Importance of Freshwater Fishes in Human Nutrition

Yogesh V. Bidwe¹, Ranjit R. Raut², Ravi G. Pradhan³

¹Department of Zoology, Dr. Rafiq Zakaria College for Women, Navkhanda, Jubilee Park, Chhatrapati Sambhajnagar, (MS), India

²Department of Zoology, Yogeshwari Mahavidyalaya Ambajogai, District Beed, (MS) India

³Department of Zoology, Lal Bahadur Shastri Arts, Commerce & Science College, Partur, District Jalna, (MS) India

Abstract

Freshwater fishes play a crucial role in global nutrition, providing a rich source of essential, minerals, vitamins, omega-3 fatty acids and proteins. As a readily accessible and cost-effective source of high-quality nutrients, they are especially important in developing countries, where they contribute significantly to food security and improve the nutritional status of populations. This review examines the nutritional value of freshwater fishes and their critical role in combating global malnutrition. It also compares the environmental sustainability of freshwater fish production with that of terrestrial protein sources, highlighting its relatively lower ecological footprint. Additionally, recent advancements in aquaculture technologies are discussed, showcasing their potential to address the growing global demand for fish products while ensuring sustainable production. However, the sector faces significant challenges, including overfishing, habitat degradation, and the adverse effects of climate change, which threaten the sustainability of fish stocks. These issues necessitate the implementation of sustainable management practices to protect aquatic ecosystems and ensure long-term fish availability. The review also underscores the importance of innovation in sustainable fisheries and aquaculture practices to enhance food security and preserve the environmental integrity of freshwater habitats. By addressing these challenges, freshwater fish can continue to be a key player in the fight against malnutrition and in meeting the nutritional needs of the global population.

Keywords: Freshwater Fishes, Human Nutrition, Food Security, Omega-3 Fatty Acids, Aquaculture, Sustainability

Introduction

Freshwater fishes are integral to the global food system, contributing significantly to human nutrition and livelihoods (Beveridge et al., 2013; Das et al., 2024). For a while, the amount of wild fish caught worldwide has been at or close to the maximum amount that water ecosystems can naturally produce (FAO, 2012; UNHRC, 2012). They are particularly important in areas with limited access to alternative protein sources (FAO, 2023). A growing amount of the world's food fish supply comes from aquaculture, which has also raised the amount of food fish available per person worldwide (Hall et al., 2011). The growth of aquaculture production worldwide is expected to be driven by market demand, which is more a result of urbanization and rising wealth than of population growth. However, the rate of increase is slowing down as the sector is increasingly impacted by resource constraints and costs, as well as the availability of space, feedstuffs, and the ability to disseminate and assimilate wastes (Beveridge et al., 2013; Merino et al., 2012). The majority of aquatic food resources in traditional, non-industrialized fisheries were nearly entirely used for plant fertilizer, animal feed, or human consumption (Gildberg, 2002; Gehring et al., 2011). Freshwater species such as tilapia, catfish, and carp are staples in many diets due to their affordability, accessibility, and nutritional richness.

Nutritional Value of Freshwater Fishes

Amino Acids and Proteins

Freshwater fishes provide good essential amino acids and proteins required for human health (Tacon and Metian, 2022; Gehring et al., 2011; Nanaobi et al., 2022). They are easily digestible and crucial for muscle development and repair.

Omega-3 Fatty Acids

Freshwater species like catfish and trout are rich sources of various fatty acids like omega-3, which are important for brain development and cardiac health (Harris, 2010 Ackman, 2021). These fatty acids also crucial in reducing inflammation and helpful in cognitive functions.

Micronutrients

Freshwater fishes are an excellent source of vitamins (B12, A and D), minerals (phosphorus, calcium, zinc and iron), essential for maintaining metabolic functions and bone health (Roos et al., 2020).

Role in Food Security and Public Health

Freshwater fishes play a pivotal role in alleviating malnutrition in developing countries. They are particularly important for vulnerable populations, including children and pregnant women, due to their nutrient density (FAO, 2023).

Reducing Protein-Energy Malnutrition

In many rural communities, freshwater fish are the primary or sole source of animal protein, reducing the prevalence of protein-energy malnutrition (Kawarazuka and Béné, 2022; La Banudi, 2024).

Contribution to Global Caloric Intake

While fish are not a major calorie source, their high nutrient-to-calorie ratio makes them vital for a balanced diet (Maulu et al., 2021; Hicks et al., 2021).

Sustainable Aquaculture and Its Role

Aquaculture has emerged as a sustainable alternative to complete the increasing demand for freshwater fish. Innovations in aquaculture technologies, like 'recirculating aquaculture systems (RAS) and integrated multitrophic aquaculture (IMTA)', have improved yield and reduced environmental impacts (Subasinghe et al., 2009; Naylor et al., 2021).

Challenges and Conservation Concerns

Despite their importance, freshwater fish populations face threats from overfishing, habitat destruction, and pollution. Climate change further exacerbates these challenges by altering freshwater ecosystems (Reid et al., 2023). Sustainable practices and conservation efforts are vital to confirm the long-standing availability of these vital resources.

Conclusion

Freshwater fishes are indispensable for global nutrition and food security. They offer high-quality nutrients and contribute to sustainable diets. However, challenges such as overfishing and habitat degradation require urgent attention. Advancing sustainable aquaculture and implementing effective conservation strategies are critical for safeguarding these valuable resources for future generations.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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