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CURRENT INSIGHTS INTO THE NUTRITIONAL PROFILE OF EDIBLE FRESHWATER AND MARINE FISH SPECIES: A REVIEW

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Abstract: Fish is an essential component of the human diet, providing high-quality proteins, essential fatty acids, vitamins, and minerals that contribute significantly to nutritional well-being. This review presents a comparative analysis of the nutritional characteristics of selected edible freshwater and marine fish species, highlighting both their similarities and distinct nutritional attributes. Freshwater and marine fish offer complementary health benefits and can collectively support a balanced and health-promoting diet. Marine species, including salmon, mackerel, and sardines, are particularly valued for their high levels of long-chain omega-3 polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), as well as for their contribution to dietary vitamin D intake. Freshwater fish are recognized for their high-quality protein content, complete amino acid profiles, and substantial amounts of B-group vitamins, particularly vitamin B12, together with essential minerals such as iodine, selenium, zinc, and calcium. Both freshwater and marine species generally contain 15-25% protein in their edible portion, providing amino acid compositions that adequately meet human nutritional requirements. While marine fish lipids are characterized by higher concentrations of EPA and DHA, freshwater fish may contain relatively greater proportions of omega-6 fatty acids. Marine species often exhibit elevated levels of selenium and zinc, whereas small freshwater fish can serve as excellent sources of highly bioavailable calcium, especially when consumed whole. Overall, the inclusion of both freshwater and marine fish in the diet can enhance nutrient intake and contribute to the prevention of nutrition-related chronic diseases.

Introduction

Fish meat has emerged as a widely consumed dietary product among the population, serving as a fundamental element of a bal-anced and health-conscious diet. From both qualitative and quantitative perspectives, its characteristics are shaped by a range of fac-tors, categorized as intrinsic and extrinsic. These factors, in interaction, determine both the nutritional properties and the widespread availability of this food. Fish can be categorized into two groups based on their lipid content: fatty fish and lean fish. Certain fatty fish exhibit a higher lipid content, whereas others are characterized by a greater proportion of protein. Lean fish are nutritional-ly important as a high-protein, low-fat food source. The vitamin composition of fish muscle tissue includes fat-soluble vitamins (A, D, K) and water-soluble B-complex vitamins. Furthermore, fish represent a significant dietary source of essential minerals, including calcium, magnesium, zinc, iodine, and selenium, among other trace elements. Fish primarily consists of 66% to 81% water, 16% to 21% protein, 1.2% to 1.5% minerals, 0.2% to 25% fat, and 0% to 0.5% carbo-hydrates.

MATERIAL AND METHOD

This study was conducted through a systematic analysis of 30 selected references, comprising peer-reviewed articles, institutional reports, and authoritative databases, focusing on publications from 2014 to 2024.

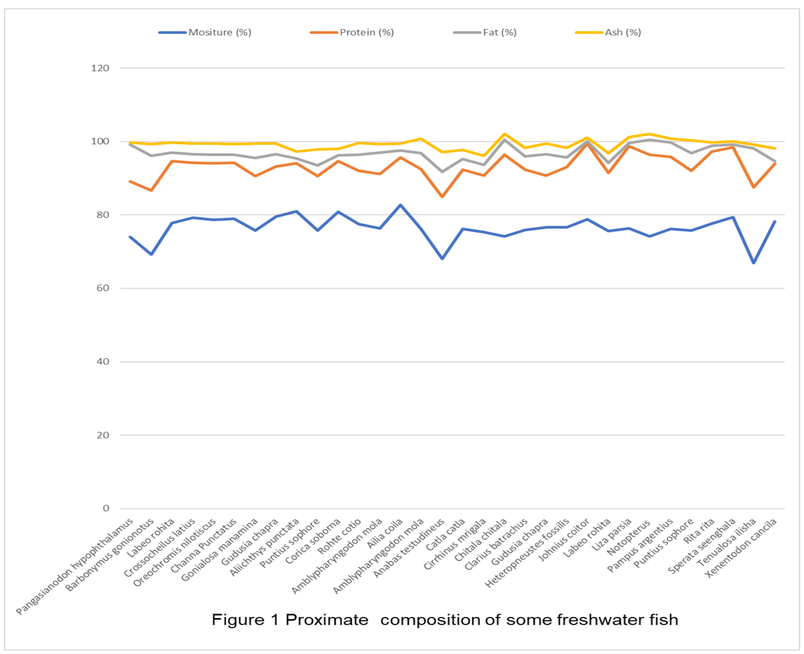


Figure 1 Proximate composition of some freshwater fish

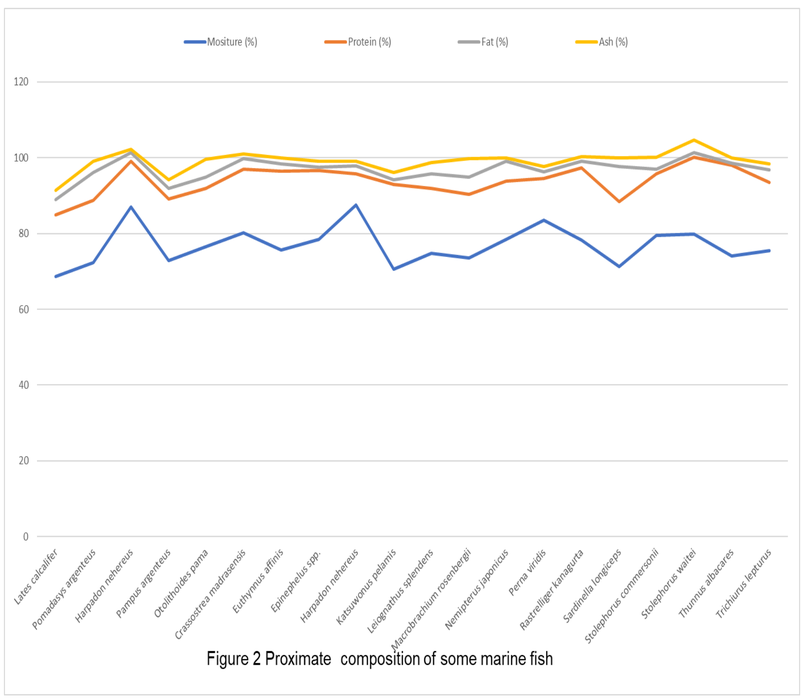


Figure 2 Proximate composition of some marine fish

DISCUSSION

Freshwater fish contained, on average, 76.42% moisture, 16.66% protein, and 3.70% lipids, while marine fish showed a similar proximate composition, with 76.91% moisture, 16.91% protein, and 3.03% lipids. Among freshwater fish minerals, Ca was the most abundant (871.9 mg/100 g), followed by Na (302.1 mg/100 g) and K (233.3 mg/100 g), whereas Zn, Fe, and Mg were present at the lowest levels, sometimes below detection limits. A similar mineral distribution was observed in marine fish, although at generally lower concentrations. In freshwater fish, saturated (SFA) and monounsaturated (MUFA) fatty acids occurred in comparable proportions (35.87% and 35.64%, respectively), while omega-6 fatty acids exceeded omega-3 fatty acids by 42%. In contrast, the marine fish specimens examined in this study exhibited a markedly higher MUFA content (27.4%) than SFA content (16.6%), representing a 66% increase. Moreover, the mean omega-3 fatty acid content was twice that of omega-6 fatty acids and 32% higher than that reported for the freshwater fish species.

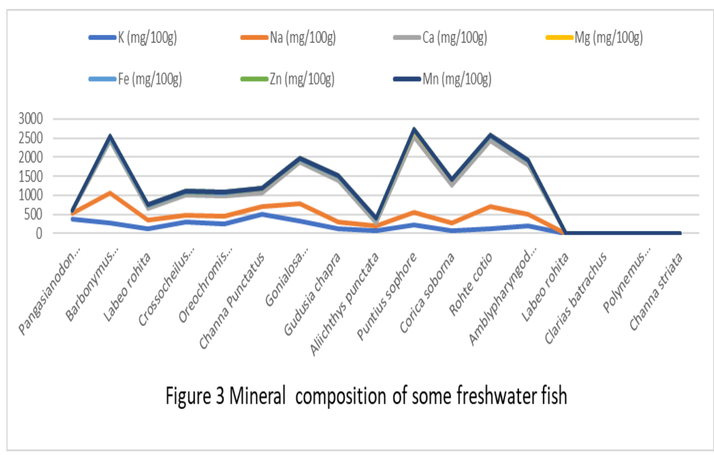


Figure 3 Mineral composition of some freshwater fish

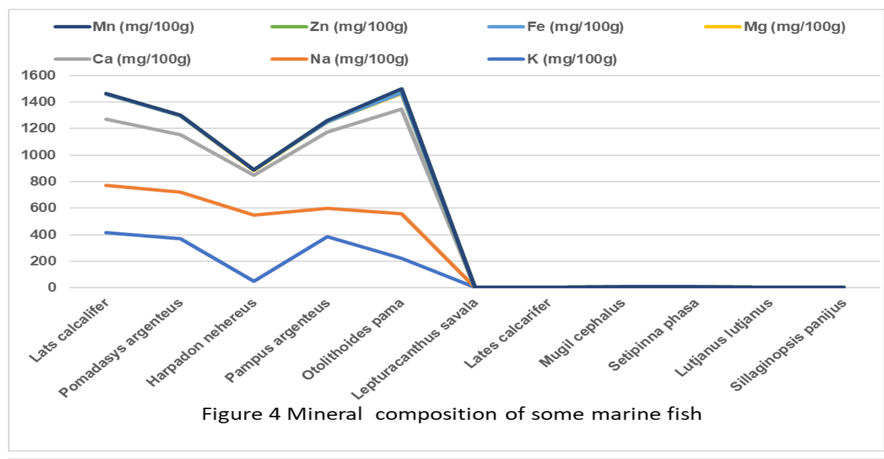


Figure 4 Mineral composition of some marine fish

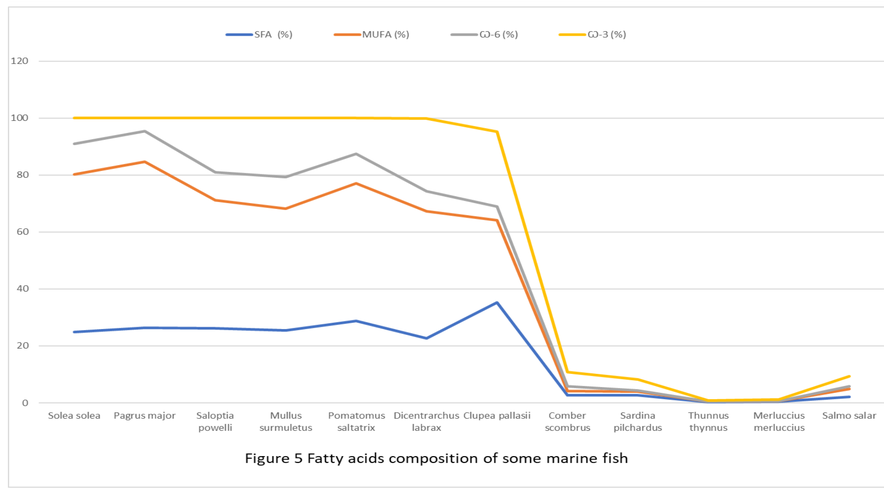


Figure 5 Fatty acids composition of some marine fish

Table 1 Fatty acids composition of some freshwater fish

Fish species	SFA (%)	MUFA (%)	ω-6 (%)	ω-3 (%)
Cyprinus carpio	24.47	60.55	10.89	4.1
Mugil cephalus	31.17	59.66	5.66	3.5
Clarias garipinus	24.12	51.94	11.52	12.44
Anguila anguila	27.04	55.53	12.15	5.3
Crucian carp wild	25.1	39.6	19.7	11.8
Labeo rohita	42.5	34.1	10.1	10.5
Labeo bata	42.2	26. 0	8.7	16. 0
Labeo calbasu	45.5	23.8	9.5	5.2
Catla catla	37.5	25.5	0 .9	9.7
Cirrhinus mrigala	41	31.4	9.4	10.9
Clarias anguillariass	73.51	26.48	n.d.	n.d.
Lates niloticus	20.63	14.46	16.61	12.62
Mormyrops anguilloides	33	16.34	25.82	8.83
Mormyrus ruma	11.77	88.23	n.d.	n.d.
Hydrocynus forskali	10.43	ND	n.d.	n.d.
Heterobranchus bidorsalis	50.28	22.58	n.d.	10.48
Hyperopisus bebe	8.79	89.9	n.d.	0.98
Clarias gariepinus	40.49	46.91	8.4	2.22
Clarihetero branchus	50.41	9.63	8.02	n.d.
Sarotherodon galilaeus	59.21	22.42	7.61	8.64
Oreochromis niloticus	64.04	21.76	4.53	8.16
Labeo rohita	34.6	33.6	n.d.	n.d.
Cirrhinus mrigala	39.4	34.7	n.d.	n.d.
Cyprinus carpio	23.2	18.6	n.d.	n.d.
Channa striatus	34.11	16.2	8.71	8.32
Clarias macrocephalus	26.24	15.51	9.53	5.57
Labeo calbasu	30.67	41.68	17.13	10.52
Amblypharyngodon mola	53	25.5	20.7	16.3
Puntius sophore	51.52	20.2	2.2	1.37

CONCLUSION

The reviewed literature revealed comparable proximate compositions between the studied freshwater and marine fish species, characterized by high protein content and relatively low lipid levels. Notably, omega-3 fatty acids represented the predominant lipid fraction in both groups. Both freshwater and marine species exhibited substantial concentrations of Ca, Na, and K. The nutrient profiles documented in this study position fish as a nutritionally valuable and complex food source, offering a balanced combination of essential nutrients.