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Biochemical composition of fish as a source of biologically active compounds and its role in the prevention of cardiometabolic disorders

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Abstract. Fish is one of the most valuable food products due to its unique combination of macro- and micronutrients that contribute to the maintenance of vital physiological functions in humans and animals. Proteins constitute the major component of fish muscle tissue, providing essential support for tissue growth and repair, maintenance of muscle mass, and proper immune system function. Fish lipids, particularly long-chain omega-3 polyunsaturated fatty acids, perform energy, structural, and regulatory functions by participating in the synthesis of bioactive compounds, regulation of lipid metabolism, and maintenance of cardiovascular health. A substantial proportion of these fatty acids, including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are biologically active components that promote nervous system development, support normal cardiac function, and contribute to the prevention of inflammatory processes. Particular attention is given to the mineral and vitamin content of fish, which is characterized by high bioavailability. Calcium, phosphorus, iron, zinc, selenium, and iodine play crucial roles in bone tissue formation, nervous system function, and metabolic processes. Fat-soluble vitamins A, D₃, and E contribute to growth, antioxidant protection, and regulation of mineral metabolism, whereas water-soluble B-group vitamins support energy metabolism, neurotransmitter synthesis, and hematopoiesis. The combined effects of these nutrients make fish an effective dietary component in the prevention of chronic diseases, including cardiovascular disorders, osteoporosis, anemia, and neurodegenerative conditions. Research indicates that the nutritional value of fish largely depends on species, rearing conditions, age, and feeding regime. Fatty marine fish species contain higher concentrations of omega-3 fatty acids, whereas small fish consumed whole provide an optimal source of calcium and other essential minerals. Lean fish species are characterized by a high protein and mineral content, making them important components of a balanced diet. The role of fish during pregnancy and lactation is also emphasized, as the intake of long-chain omega-3 fatty acids and vitamins during these periods is critical for the development of the fetal and neonatal nervous system. The findings of this study highlight the need for systematic evaluation of the nutritional value of various fish species, particularly local and commercially important resources, as well as the integration of fish into national healthy nutrition programs. Future research directions include assessing the impact of processing technologies on nutrient retention, determining the optimal frequency of fish consumption for different population groups, investigating the potential of aquaculture as a source of high-quality protein and micronutrients, and conducting interdisciplinary studies on the effects of fish consumption on physiological, metabolic, and cognitive health outcomes in humans. Therefore, fish should be regarded not only as a food product but also as a functional food capable of positively influencing public health by supporting the normal development and functioning of the cardiovascular, nervous, hematopoietic, immune, and endocrine systems. Regular inclusion of fish in the diet represents an important strategy for achieving balanced nutrition and preventing a wide range of chronic and metabolic diseases.

Keywords: aquaculture, biochemical composition, fish meat, high-quality proteins, omega-3 polyunsaturated fatty acids, nutritional value, cardiovascular system

Ensuring food security is one of the key priorities of a modern state, as it directly affects public health, the physical and social development of society, and economic stability (Arakelova,

2022; Dunaievskaya, 2022). Food security implies guaranteed access to nutritionally adequate, high-quality, and safe food products in sufficient quantities and with appropriate diversity (Bogard, 2017; Franchuk, 2022). An important component of this process is not only the availability of food products but also their biological value and safety, as the quality of food ultimately determines its impact on human and animal health (Jiang, 2024; Furman, 2024).

The development of national food production has become particularly important. Reducing dependence on imports is a key prerequisite for strengthening food security (Dunaievskaya, 2025). A substantial share of imported food products on the domestic market, particularly fish and fish products, highlights the need to expand domestic production as an important means of enhancing the country's food independence and improving public health (Andrushchenko, 2025). In this context, aquaculture occupies a significant position within the food supply system due to its considerable resource potential in Ukraine (Shepelev, 2016). The total area of water bodies suitable for fish farming is approximately 1.3 million hectares; however, only a portion of these resources is currently utilized. Fish production volumes demonstrate a positive trend but remain below their potential capacity. At the same time, fish consumption among the Ukrainian population remains insufficient and does not meet recommended dietary standards, underscoring the need for further development of the aquaculture sector (Myskovets, 2020; Trofymchuk, 2021).

In this regard, global data on fish consumption and nutritional value demonstrate its important role in ensuring food security. Fish provides approximately 17% of animal protein and 7% of the total protein consumed worldwide, while about 3.3 billion people rely on it as a primary source of protein and essential micronutrients (FAO, 2018). According to the Food and Agriculture Organization (FAO), the average per capita fish consumption reached approximately 20.5 kg per year in 2018, highlighting its significant contribution to the development of a balanced and nutritious diet (FAO, 2020).

Aquaculture in Ukraine is represented by various forms of production, including pond-based, cage-based, and industrial fish farming, as well as mariculture. The main cultivated species include traditional freshwater fish such as common carp (mirror carp included), silver carp (both white and variegated), grass carp, and pike-perch. At the same time, recent years have shown growing interest in more valuable and high-yield fish species with increased biological and market value, particularly trout (especially rainbow trout) and salmon (Mykhalchyshyna, 2020; Prysiachniuk, 2025). The development of modern fish farming technologies contributes to improving production efficiency and the quality of fish products (FAO, 2018; Borshchenko, 2026).

Among animal-derived food products, fish holds a special place due to its high nutritional and biological value (Noreen, 2025). It is a source of high-quality protein, lipids, vitamins, and minerals, and is characterized by high digestibility and a well-balanced amino acid profile (Ali et al., 2022; Manz, 2023). On average, 100 g of fish meat contains 11.9–20.6 g of protein and 0.3–18.3 g of fat, indicating the high nutritional value of this product (FAO, 2020).

Long-chain omega-3 fatty acids (EPA and DHA) possess particular physiological significance, as they are actively involved in the regulation of lipid metabolism, attenuation of inflammatory processes, and maintenance of cardiovascular and nervous system functions (Harris, 2008; Calder, 2010). Regular consumption of fish has been associated with a reduced risk of cardiovascular diseases, improvement of blood lipid profiles, and prevention of metabolic disorders such as dyslipidemia, obesity, and type 2 diabetes mellitus (Simopoulos, 1991; Innis, 2008; Calder, 2022). These effects are largely attributed to the synergistic action of omega-3 fatty acids and other bioactive nutrients present in fish.

In addition, fish represents an important dietary source of vitamins, including A, D, and B-group vitamins, as well as essential mineral elements such as calcium, phosphorus, magnesium, iodine, selenium, and iron. These micronutrients play a crucial role in bone tissue formation, metabolic regulation, and the proper functioning of the endocrine system (Holick, 2007; Zimmermann, 2009). Adequate intake of these components is essential for maintaining physiological homeostasis and supporting normal growth and development. Biologically active compounds derived from fish also contribute to the optimal functioning of enzymatic systems and are involved in maintaining cellular and systemic homeostasis in the organism (Rayman, 2012). Furthermore, the combined action of these nutrients enhances antioxidant defense mechanisms, supports immune responses, and contributes to the overall resilience of the human body against chronic diseases.

International and national health organizations (including FAO and WHO) recommend the regular inclusion of fish in the diet across all age groups. The required level of fish consumption varies depending on age and physiological status. In childhood and adolescence, fish serves as an important source of protein, calcium, and B-group vitamins, which are essential for growth and proper development of the organism. For the adult population, it contributes to the maintenance of metabolic balance and normal cardiovascular function, whereas in pregnant and lactating women, the demand for omega-3 fatty acids and vitamin D increases significantly, highlighting its crucial role in supporting the normal development of the fetal and neonatal nervous systems (Stabler, 2024). In athletes, fish is considered an essential component of the diet, as high-quality proteins promote muscle repair and growth, while omega-3 fatty acids help reduce post-exercise inflammatory responses and support both cardiovascular and nervous system function during periods of intensive physical activity (Senphan, 2025).

In older adults, the rational consumption of fish helps maintain cognitive functions, reduces the risk of cardiovascular diseases, facilitates the control of blood lipid profiles, and supports the prevention of osteoporosis due to its content of calcium, phosphorus, and vitamin D (Simopoulos, 1991; Harris, 2008).

Therefore, in this context, the regular inclusion of fish in the diet acquires particular importance as an effective tool of nutritional prevention and the maintenance of physiological functions of the organism. Its systematic consumption represents a scientifically substantiated approach to the prevention of cardiovascular diseases and metabolic disorders. According to research data (Harris, 2008), the intake of 2–3 servings of fish per week reduces the risk of developing ischemic heart disease, normalizes blood cholesterol and triglyceride levels, improves cognitive functions, and contributes to the strengthening of bone tissue (Innis, 2008).

Thus, fish is a valuable component of a healthy diet due to its high content of high-quality proteins, omega-3 fatty acids, vitamins, and minerals. Regular consumption of fish supports metabolic homeostasis and contributes to the prevention of cardiovascular and metabolic diseases. The obtained data confirm the feasibility of including fish products in strategies for healthy nutrition and the promotion of public health.

The aim of this article is to summarize current scientific data on the biochemical composition of fish, to analyze its main nutrients, and to determine their role in maintaining human health, particularly in the prevention of cardiovascular diseases and metabolic disorders.

Materials and methods. To prepare this article, a systematic analysis of the scientific literature on the biochemical composition of fish, its nutritional value, and its role in the prevention of cardiometabolic disorders was conducted. Information was retrieved from international scientometric databases, including PubMed, Scopus, Web of Science, and Google Scholar, as well as from official reports and analytical materials published by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO).

The analysis included scientific studies focusing on the protein, lipid, vitamin, and mineral composition of fish, the biological role of omega-3 polyunsaturated fatty acids, as well as the effects of regular consumption of fish products on human health. The interpretation and synthesis of the obtained data were carried out using methods of analysis, synthesis, comparison, systematization, and generalization of scientific information. This methodological approach made it possible to summarize current evidence on the nutritional and biological value of fish and to substantiate its significance in the prevention of cardiovascular and metabolic disorders.

Results and Discussion. *Comparative biochemical composition of freshwater and marine fish species.* Nutrients are biologically active compounds that provide energy to the organism, support growth, maintain the structural integrity of tissues, and participate in their repair. They are classified into macronutrients and micronutrients, both of which are essential for maintaining optimal health. Fish and fish products occupy a special place as food sources in providing humans and animals with essential nutrients and biologically active compounds (Tufail, 2025).

The biochemical composition of fish meat is characterized by a high-water content, ranging from 65–80% of the product mass, which contributes to its good digestibility and relatively low energy value. Protein content varies between 15–20%, and these proteins are of high biological value, containing all essential amino acids. The lipid fraction depends on the fish species and may range from 5 to 20%, determining both its caloric value and the content of biologically active fatty acids. Mineral substances account for 0.5–2% and are represented primarily by calcium,

phosphorus, potassium, magnesium, and a range of essential trace elements. This composition of major nutrients ensures the high nutritional and biological value of fish, making it an important source of macro- and micronutrients in the human diet (Ghaly, 2013).

In addition, an important feature of fish is the high bioavailability of its nutrients, which is largely due to the structure of muscle tissue and the low content of connective tissue compared to terrestrial animal meat (Mohanty, 2019). These differences become more evident when analyzing individual fish species. The average content of major nutritional components in 100 g of meat from different fish species is presented in Table 1 (Partanen, 2023).

Table 1

Average content of main nutrients in 100 g of different fish species

Fish species	Protein (g)	Fat (g)	Omega-3 (g)	Vitamin D (µg)	Calcium (mg)
Carp	17.0	4.0	0.3	1.2	30
Silver carp	16.5	3.5	0.2	1.1	25
Trout	19.0	6.0	1.0	11.0	40
Pike-perch	18.5	1.5	0.4	2.0	20
Herring	18.0	12.0	2.0	16.0	35

The analysis of the data presented in Table 1 indicates pronounced differences in the biochemical composition of various fish species, which determine their distinct nutritional and functional value. In particular, freshwater species (carp, silver carp, and pike-perch) are characterized by a relatively stable protein content (16.5–18.5 g/100 g), but differ in their low levels of lipids and, consequently, omega-3 fatty acids (0.2–0.4 g/100 g). The lowest fat content is observed in pike-perch (1.5 g/100 g), which allows it to be classified as a dietary product.

In contrast, marine and semi-anadromous species such as herring are characterized by a significantly higher lipid content (up to 12 g/100 g) and omega-3 fatty acids (up to 2.0 g/100 g), which underlies their pronounced cardioprotective effects. The higher lipid content in marine and fatty fish species directly correlates with increased levels of omega-3 fatty acids and fat-soluble vitamins, providing a metabolically regulatory effect, particularly on lipid profiles, blood pressure, and inflammatory markers. Trout, which is mainly farmed in aquaculture systems, occupies an intermediate position: it combines a high protein content (19 g/100 g) with a moderate fat level (6 g/100 g) and a substantial amount of omega-3 fatty acids (1.0 g/100 g), making it a versatile product in terms of nutritional value. Comparative analysis also shows that fatty fish species (herring, trout) contain significantly higher levels of vitamin D (11–16 µg/100 g) compared to lean freshwater species (1.1–2.0 µg/100 g). This is associated with the accumulation of this vitamin in the lipid fraction. Calcium content varies less markedly (20–40 mg/100 g), but tends to be higher in species with greater fat content and more intensive metabolic activity.

Thus, freshwater and marine fish species differ significantly in their biochemical composition and nutritional value. Freshwater fish are generally characterized by a lower lipid content and reduced levels of omega-3 fatty acids, whereas marine species represent an important dietary source of polyunsaturated fatty acids and fat-soluble vitamins essential for human health. These differences determine their distinct physiological and functional roles in human nutrition. Incorporating a variety of fish species into the diet ensures a more balanced intake of essential nutrients, including high-quality proteins, essential fatty acids, vitamins, and minerals. Such dietary diversity contributes to the optimization of metabolic processes, supports cardiovascular and nervous system function, and plays a preventive role in reducing the risk of cardiometabolic disorders. Consequently, regular consumption of both freshwater and marine fish can be considered a scientifically grounded component of strategies aimed at improving public health and promoting long-term nutritional well-being.

Proteins of fish meat and their biological significance. Fish is one of the most important sources of animal protein in human nutrition (Mendivil, 2021). According to estimates by international organizations, for more than 3 billion people it represents the primary source of animal protein, and in some regions, it accounts for over 30% of total dietary protein intake (Béné, 2015; FAO, 2020). The high nutritional value of fish is determined by its significant content of high-quality proteins characterized by good digestibility and a well-balanced amino acid composition (Dale, 2019). Fish proteins contain all essential amino acids, including lysine,

methionine, threonine, tryptophan, and isoleucine, which are required for protein synthesis, regulation of metabolic processes, and maintenance of immune function in the organism. Sulfur-containing amino acids are also of particular importance, as they participate in detoxification processes and antioxidant defense mechanisms (Mohanty, 2019; Partanen, 2023).

Fish protein plays an important role in tissue construction and repair, as well as in the synthesis of enzymes, hormones, and other biologically active compounds. During protein hydrolysis, bioactive peptides are formed that may exhibit antioxidant, antihypertensive, and immunomodulatory properties (Shahidi, 2025). Due to the low content of connective tissue and collagen, fish proteins are more easily subjected to enzymatic digestion, and their digestibility coefficient reaches 90–95% (Mohanty, 2019; Partanen, 2023).

From a biochemical perspective, fish proteins are represented by myofibrillar, sarcoplasmic, and stromal fractions, which support structural, metabolic, and functional processes in the organism. The protein content in the edible portion of fish typically ranges from 15–20%, although it may vary depending on species and environmental conditions (Mohanty, 2019; Partanen, 2023). These differences are particularly evident when comparing freshwater species (e.g., carp) and marine species (e.g., tuna) (Table 2).

Table 2

Protein content in the meat of different fish species (per 100 g of edible portion)

Fish species	Protein content, g/100 g	Biological characteristics
Atlantic cod (<i>Gadus morhua</i>)	17–18	Lean fish with high protein digestibility
European hake (<i>Merluccius merluccius</i>)	16–18	Source of high-quality protein and essential amino acids
Alaska pollock (<i>Gadus chalcogrammus</i>)	17–19	Low fat content, high nutritional value
Atlantic herring (<i>Clupea harengus</i>)	17–19	Rich in protein and omega-3 fatty acids
Atlantic salmon (<i>Salmo salar</i>)	19–21	High content of protein and polyunsaturated fatty acids
Rainbow trout (<i>Oncorhynchus mykiss</i>)	19–20	Source of easily digestible protein and trace elements
Atlantic bluefin tuna (<i>Thunnus thynnus</i>)	22–24	One of the highest protein contents among fish species
Atlantic mackerel (<i>Scomber scombrus</i>)	18–20	Protein of high biological value
Common carp (<i>Cyprinus carpio</i>)	16–18	Well-balanced amino acid composition

Table 2 presents the protein content in the meat of different fish species, ranging from 16 g/100 g in crucian carp to 24 g/100 g in tuna (Mohanty, 2019; Partanen, 2023). Lean fish species (such as cod, hake, and pollock) are characterized by high protein digestibility and a favorable amino acid profile. Herring, salmon, trout, and mackerel combine a considerable protein content with a high concentration of omega-3 polyunsaturated fatty acids, whereas tuna is among the leading species in terms of protein content among commercially important fish. Carp and crucian carp are also valuable sources of easily digestible protein.

Thus, different fish species provide the organism with high-quality protein, while fatty marine species additionally serve as a source of biologically active omega-3 fatty acids, enhancing their importance in the prevention of cardiometabolic disorders.

Lipid composition of fish and functional properties of lipids. Fish lipids perform energy, structural, and regulatory functions by participating in the synthesis of biologically active compounds and in key metabolic processes (Brockerhoff, 1963; Harris, 2008; Calder, 2010). The fat content in the edible portion of fish varies from 0.5 to 20%, which forms the basis for classifying fish into lean, medium-fat, and fatty categories (Simopoulos, 1991; Méndez, 2017).

Of particular value among fish lipids are long-chain omega-3 polyunsaturated fatty acids—eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)—which are involved in the regulation of numerous physiological processes in the human body (Lauritzen et al., 2001; Innis, 2008; Calder, 2010). In addition, the lipid fraction of fish contains phospholipids, triglycerides, and

cholesterol, which ensure the structural integrity of cell membranes, facilitate the transport of fat-soluble vitamins, support energy metabolism, and contribute to the synthesis of biologically active compounds (Calder, 2010). The main omega-3 fatty acids in fish and their biological significance are presented in Table 3.

Table 3 presents the main omega-3 fatty acids in fish and their biological significance. The most important among them are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which contribute to the maintenance of the cardiovascular, nervous, and immune systems. Alpha-linolenic acid (ALA) serves as a precursor of EPA and DHA and is involved in the regulation of lipid metabolism (Harris, 2001; Innis, 2008; Calder, 2010).

Omega-3 fatty acids in fish, primarily EPA and DHA, contribute to the regulation of lipid metabolism, reduction of inflammatory processes, and support of cardiovascular and nervous system functions (Galli, 2009; Turunen, 2013; Tatoli, 2025). In combination with antioxidants such as vitamin E and selenium, they provide cellular protection against oxidative stress and may reduce the risk of cardiometabolic disorders (Lauritzen, 2001).

Table 3

Main omega-3 fatty acids in fish and their biological significance

Fatty acid	Chemical formula	Main functions in the organism
Eicosapentaenoic acid (EPA)	C20:5 n-3	Reduction of blood triglyceride levels, anti-inflammatory effects, decreased risk of cardiovascular diseases
Docosahexaenoic acid (DHA)	C22:6 n-3	Brain development, nervous system function, visual system formation
Alpha-linolenic acid (ALA)	C18:3 n-3	Precursor of EPA and DHA, regulation of lipid metabolism

The biological value of fish lipids largely depends on processing and cooking methods, as high temperatures may reduce the content of polyunsaturated fatty acids (Lauritzen, 2001). In addition, fish is an important source of vitamin D, calcium, and other essential nutrients (Lu, 2007; Noreen, 2025). Considering its high nutritional value, international and national health organizations recommend the regular inclusion of fish products in the diet. Recommended fish consumption levels are presented in Table 4 (Harris, 2008; Calder, 2010).

The data presented in Table 4 indicate that the recommended levels of fish consumption depend on age and physiological status, with the highest requirements observed in pregnant and lactating women. Regular fish consumption ensures an adequate intake of omega-3 fatty acids, fat-soluble vitamins, and other biologically active compounds that support the cardiovascular, nervous, and immune systems and contribute to the prevention of chronic diseases.

Table 4

Recommended daily fish intake for different population groups

Population group	Recommendations (g/day)
Children 1–3 years	30–50
Children 4–12 years	50–70
Adults	100–150
Pregnant and lactating women	150–200

Carbohydrates in fish. Carbohydrates in fish are mainly represented by glycogen, which accumulates in muscle tissue and internal organs. Their content in most fish species is low and ranges from 0.1 to 1.5% of the edible portion mass (Mohanty, 2019). The primary function of glycogen is to provide energy requirements and support metabolic processes (Lauritzen, 2001). Glycogen content may vary depending on fish species and metabolic characteristics (Zou, 2025).

Despite its relatively low concentration, fish carbohydrates serve as an easily digestible source of energy and contribute to the overall nutritional value of fish products (Polakof, 2012).

Mineral and vitamin composition of fish. Fish is an important source of minerals and vitamins involved in the regulation of metabolic processes and the maintenance of physiological functions of the organism (Bermejo, 2025). The mineral elements in fish are characterized by high bioavailability and play a significant role in bone tissue formation, maintenance of water-

electrolyte balance, and proper functioning of the nervous and cardiovascular systems (Rayman, 2012).

Fish provides essential minerals such as calcium, phosphorus, iron, zinc, selenium, and iodine, which are necessary for the normal functioning of the human body (Table 5) (Rayman, 2012; Lall, 2021).

As shown by the data in Table 5, fish is an important source of bioavailable mineral substances that are involved in the regulation of key physiological processes. Calcium and phosphorus contribute to bone tissue formation and energy metabolism, while magnesium supports the proper functioning of the nervous and cardiovascular systems (Masuyama, 2003; Gutiérrez, 2020).

In addition to minerals, fish is also an important source of vitamins that perform regulatory functions (Table 6). The vitamins present in fish include both fat-soluble vitamins (A, D, E) and water-soluble vitamins (B group), making this food product a versatile source for meeting the body's requirements for these essential compounds (Holick, 2007; Stabler, 2013).

The analysis of the data presented in Table 6 indicates that fish is an important source of fat-soluble vitamins A, D, and E, as well as B-group vitamins. Vitamins A and D are predominantly concentrated in fatty fish species and fish oil; vitamin A supports visual function, growth, and immune system activity, whereas vitamin D regulates calcium and phosphorus metabolism and contributes to the maintenance of bone tissue (Underwood, 1996; Holick, 2022). Vitamin E performs an antioxidant function, protecting cells from oxidative stress (Calder, 2017).

Table 5

Main minerals in fish and their functions		
Mineral	Average content (mg/100 g)	Main functions in the organism
Calcium (Ca)	50–150	Bone and teeth formation, muscle contraction, cardiac activity
Phosphorus (P)	200–300	Energy metabolism (ATP), bone and teeth formation
Iron (Fe)	1,0–2,5	Oxygen transport, hemoglobin synthesis, immune system function
Zinc (Zn)	0,5–1,2	Enzymatic activity, immune function, tissue growth
Selenium (Se)	15–35 µg	Antioxidant protection, thyroid gland function
Iodine (I)	15–50 µg	Synthesis of thyroid hormones, brain development

Table 6

Main vitamins in fish and their biological role		
Vitamin	Content (per 100 g)	Main functions
A (retinol)	100–500 µg	Vision, growth and development, immune function
D ₃ (cholecalciferol)	5–20 µg	Regulation of calcium and phosphorus, bone health
E (tocopherol)	1–3 mg	Antioxidant protection, immunity
B ₁ (thiamine)	0,1–0,3 mg	Energy metabolism, nervous system
B ₂ (riboflavin)	0,1–0,2 mg	Enzyme synthesis, energy metabolism
B ₃ (niacin)B ₃	2–5 mg	Metabolism, cholesterol regulation
B ₆ (pyridoxine)	0,1–0,5 mg	Amino acid metabolism, neurotransmitter synthesis
B ₁₂ (cobalamin)	2–7 µg	Hematopoiesis, nervous system, DNA synthesis
Folic acid	10–50 µg	Nucleic acid synthesis, fetal development

B-group vitamins are involved in energy metabolism, hematopoiesis, and nervous system function; in particular, vitamin B12 and folic acid are critically important for DNA synthesis and the prevention of anemia (Stabler, 2013). Overall, fish provides the organism with a complex of vitamins necessary for maintaining essential physiological functions and preventing deficiency states.

Thus, fish is a valuable source of vitamins and minerals, which underpins its role in supporting the function of major body systems and in the prevention of metabolic disorders.

Conclusions. Fish is a valuable food product due to its high content of high-quality protein, lipids, omega-3 polyunsaturated fatty acids, vitamins, and minerals. It provides a range of biologically active compounds (EPA, DHA, vitamins A, D, E, B-group vitamins, calcium, phosphorus, iron, selenium, iodine), which are involved in the regulation of key physiological processes and the maintenance of cardiovascular, nervous, and immune system functions.

Regular consumption of fish contributes to the prevention of cardiometabolic disorders, osteoporosis, anemia, and other chronic diseases, while also having a positive effect on metabolism and overall physiological status. It has been established that different fish species vary in their nutrient composition, which justifies the inclusion of both marine and freshwater fish in the human diet. Small fish species consumed whole are of particular value, as they provide an additional source of highly bioavailable minerals.

Thus, fish should be regarded not only as a food product but also as a functional food with preventive potential against chronic diseases.

The prospect of further research

Further research should focus on an in-depth investigation of the biochemical composition of different fish species, the bioavailability of their key nutrients, and the impact of regular fish consumption on the prevention of cardiometabolic disorders. The obtained findings will contribute to the scientific substantiation of rational dietary approaches for the population.

References

1. Ali A., Wei S., Ali A., Khan I., Sun Q., Xia Q., Wang Z., Han Z., Liu Y., & Liu S. (2022). Research Progress on Nutritional Value, Preservation and Processing of Fish-A Review. *Foods (Basel, Switzerland)*; 11(22):3669. doi:10.3390/foods11223669.
2. Andrushchenko A. (2025). Improving approaches to the formation and regulation of the aquaculture sector's competitiveness under the pressure of food resource shortages. *Ukrainian Journal of Applied Economics and Technology*; 10(2):174–178. doi:10.36887/2415-8453-2025-2-34.
3. Arakelova A. R., Hrynko A. Ye., & Yevtifiieva Yu. V. (2022). Ensuring food security of ukraine in the conditions of martial law: agrarian and legal aspect. *Legal Scientific Electronic Journal*; 10:332–335. doi:10.32782/2524-0374/2022-10/80.
4. Béné C., Barange M., Subasinghe R., Pinstup-Andersen P., Merino G., Hemre G., & Williams M. (2015). Feeding 9 billion by 2050 – putting fish back on the menu. *Food Policy*; 50:62–76. doi: 10.1007/s12571-015-0427-Z.
5. Bermejo L. M., González-Rodríguez L. G., Lozano Estevan M. C., Cervera-Muñoz A., & Aparicio A. (2025). Nutritional and health importance of fish consumption. Current intake compared to recommendations. *Nutricion hospitalaria*; 42(1):27–32. doi:10.20960/nh.06087.
6. Bogard J. R., Farook S., Marks G. C., Waid J., Belton B., Ali M., Toufique K., Mamun A., & Thilsted S. H. (2017). Higher fish but lower micronutrient intakes: Temporal changes in fish consumption from capture fisheries and aquaculture in Bangladesh. *PloS one*; 12(4):e0175098. doi:10.1371/journal.pone.0175098.
7. Borshchenko V., Obertukh Y., Lavryniuk O., Piddubna L., Sokulskyi I., & Gutyj B. (2026). Digitalization and technological support of precision feeding in modern aquaculture. *Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Agricultural sciences*; 28(104):44–54. doi: 10.32718/nlvvet-a10407.
8. Brockerhoff H., Ackman R. G., & Hoyle R. J. (1963). Specific distribution of fatty acids in marine lipids. *Archives of biochemistry and biophysics*; 100, 9–12. doi:10.1016/0003-9861(63)90026-2.
9. Calder P. C. (2010). Omega-3 fatty acids and inflammatory processes. *Nutrients*; 2(3):355–374. doi:10.3390/nu2030355.
10. Calder P. C. (2022). Omega-3 fatty acids and metabolic partitioning of fatty acids within the liver in the context of nonalcoholic fatty liver disease. *Current opinion in clinical nutrition and metabolic care*; 25(4):248–255. doi:10.1097/MCO.0000000000000845.
11. Dale H. F., Madsen L., & Lied G. A. (2019). Fish-derived proteins and their potential to improve human health. *Nutrition reviews*; 77(8):572–583. doi:10.1093/nutrit/nuz016.

12. Dunaievska O. F., Sokulskyi I. M., Gutyj B. V., & Radzyhovskyi M. L. Environmental aspects of livestock farming as a factor in food security in Ukraine. *Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Agricultural sciences*; 27(102):419–428. doi:10.32718/nvlvet-a10260.
13. Dunaievska O., Sokulskyi I., Melnyk N., & Pitsil A. (2024). Environmental problems of agriculture under martial law. *Environmental Sciences*; 1(52):22–27. doi:10.32846/2306-9716/2024.eco.1-52.1.3.
14. FAO. (2018). State of the world fisheries and aquaculture 2018 – Achieving the goals of sustainable development. Rome. License:CC BY-NC-SA 3.0 IGO.
15. FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. doi:10.4060/ca9229en.
16. Franchuk V., Kopytko M., & Melnyk S. (2022). Ensuring food security in Ukraine in the conditions of a changing security environment. *Scientific Notes of the University "KROK"*; 3(67):9–17. doi:10.31732/2663-2209-2022-67-9-17.
17. Furman S. V., Sokulskyi I. M., Lisohurska D. V., Lisohurska O. V., & Guty, B. V. (2024). Key indicators of beef safety and quality as important aspects of conservation. *Ukrainian Journal of Veterinary and Agricultural Sciences*; 7(1):68–73. doi:10.32718/ujvas7-1.11.
18. Galli C., Risé P. (2009). Fish consumption, omega 3 fatty acids and cardiovascular disease. The science and the clinical trials. *Nutrition and health*; 20(1):11–20. doi:10.1177/026010600902000102.
19. Ghaly A. E, Ramakrishnan V. V, Brooks M. S, Budge S. M, & Dave D. (2013) Fish Processing Wastes as a Potential Source of Proteins, Amino Acids and Oils: A Critical Review. *J Microb Biochem Techno*; 5:107–129. doi:10.4172/1948-5948.1000110.
20. Gutiérrez O. M., Porter A. K., Viggeswarapu M., Roberts J. L., & Beck G. R. (2020). Effects of phosphorus and calcium to phosphorus consumption ratio on mineral metabolism and cardiometabolic health. *The Journal of nutritional biochemistry*; 80:108374. doi:10.1016/j.jnutbio.2020.108374.
21. Harris W. S., Miller M., Tighe A. P., Davidson M. H., & Schaefer E. J. (2008). Omega-3 fatty acids and coronary heart disease risk: clinical and mechanistic perspectives. *Atherosclerosis*; 197(1):12–24. doi:10.1016/j.atherosclerosis.2007.11.008.
22. Holick M. F. (2007). Vitamin D deficiency. *The New England journal of medicine*; 357(3):266–281. doi:10.1056/NEJMra070553.
23. Innis S. M. (2008). Dietary omega 3 fatty acids and the developing brain. *Brain research*; 1237:35–43. doi:10.1016/j.brainres.2008.08.078.
24. Jiang B., Pang J., Li J., Mi L., Ru D., Feng J., Li X., Zhao A., & Cai L. (2024). The effects of organic food on human health: a systematic review and meta-analysis of population-based studies. *Nutrition reviews*; 82(9):1151–1175. doi:10.1093/nutrit/nuad124.
25. Lall S. P., & Kaushik S. J. (2021). Nutrition and Metabolism of Minerals in Fish. *Animals : an open access journal from MDPI*; 11(9):2711. doi:10.3390/ani11092711.
26. Lauritzen L., Hansen H. S., Jørgensen M. H., & Michaelsen K. F. (2001). The essentiality of long chain n-3 fatty acids in relation to development and function of the brain and retina. *Progress in lipid research*; 40(1-2):1–94. doi:10.1016/s0163-7827(00)00017-5.
27. Lu Z., Chen T. C., Zhang A., Persons K. S., Kohn N., Berkowitz R., Martinello S., & Holick, M. F. (2007). An evaluation of the vitamin D3 content in fish: Is the vitamin D content adequate to satisfy the dietary requirement for vitamin D? *The Journal of steroid biochemistry and molecular biology*; 103(3-5), 642–644. doi:10.1016/j.jsbmb.2006.12.010.
28. Manz J. C. K., Nsoga J. V. F., Diazenza J. B., Sita S., Bakana G. M. B., Francois A., Ndomou M., Gouado I., & Mamonekene V. (2023). Nutritional composition, heavy metal contents and lipid quality of five marine fish species from Cameroon coast. *Heliyon*; 9(3), e14031. doi:10.1016/j.heliyon.2023.e14031.
29. Masuyama R., Nakaya Y., Katsumata S., Kajita Y., Uehara M., Tanaka S., Sakai A., Kato S., Nakamura T., & Suzuki K. (2003). Dietary calcium and phosphorus ratio regulates bone mineralization and turnover in vitamin D receptor knockout mice by affecting intestinal calcium and phosphorus absorption. *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research*; 18(7):1217–1226. doi:10.1359/jbmr.2003.18.7.1217.
30. Méndez L., Dasilva G., Taltavull N., Romeu M., & Medina I. (2017). Marine Lipids on Cardiovascular Diseases and Other Chronic Diseases Induced by Diet: An Insight Provided by Proteomics and Lipidomics. *Marine drugs*; 15(8):258. doi:10.3390/md15080258.
31. Mendivil C. O. (2021). Fish Consumption: A Review of Its Effects on Metabolic and Hormonal Health. *Nutrition and metabolic insights*; 14, 11786388211022378. doi:10.1177/11786388211022378.
32. Mohanty B. P., Mahanty A., Ganguly S., Mitra T., Karunakaran D., & Anandan R. (2019). Nutritional composition of food fishes and their importance in providing food and nutritional security. *Food chemistry*; 293:561–570. doi:10.1016/j.foodchem.2017.11.039.
33. Mykhalyshyna L., & Sinenok I. (2020). Strategic directions of aquaculture development in Ukraine . *Economics and Business Management*; 11(2):91–108.
34. Myskovets N. P. (2020). Analyzing the Current Status and Prospects of Fishing Industry in Ukraine. *Biznes Inform*; 3:104–111. doi:10.32983/2222-4459-2020-3-104-111.

35. Noreen S., Hashmi B., Aja P. M., & Atoki A. V. (2025). Health benefits of fish and fish by-products-a nutritional and functional perspective. *Frontiers in nutrition*; 12:1564315. doi:10.3389/fnut.2025.1564315.
37. Partanen M., Honkapää K., Hiidenhovi J., Kakko T., Mäkinen S., Kivinen S., Aitta E., Väkeväinen K., & Aisala H. (2023). Comparison of Commercial Fish Proteins' Chemical and Sensory Properties for Human Consumption. *Foods (Basel, Switzerland)*; 12(5):966. doi:10.3390/foods12050966.
38. Polakof S., Panerat S., Soengas J. L., & Moon T. W. (2012). Glucose metabolism in fish: a review. *Journal of comparative physiology. B, Biochemical, systemic, and environmental physiology*; 182(8):1015–1045. doi:10.1007/s00360-012-0658-7.
39. Prysiashniuk N., Hrynevych N., Slobodeniuk O., & Vdovychenko O. (2025). Export potential of Ukrainian aquaculture: an economic and ecological approach to development. *Economic Analysis*; 35(2):204–213. doi:10.35774/econa2025.02.204.
40. Rayman M. P. (2012). Selenium and human health. *Lancet (London, England)*; 379(9822):1256–1268. doi:10.1016/S0140-6736(11)61452-9.
41. Senphan T., Mungmueang N., Choommongkol V., Sriket C., Kishimura H., Kittiphattanabawon P., & Benjakul S. (2025). Improving calcium bioavailability from fish bone waste: the role of sodium hydroxide in bio-calcium extraction from tilapia (*Oreochromis niloticus*) bones. *Food chemistry*; X; 31, 103126. doi:10.1016/j.fochx.2025.103126.
42. Shahidi F., & Saeid A. (2025). Bioactivity of Marine-Derived Peptides and Proteins: A Review. *Marine drugs*; 23(4):157. doi:10.3390/md23040157.
43. Shepelev S. S. (2016). The competitiveness of the fisheries through the prism of the impact of the growing global market. *Scientific Bulletin of Polissia*; (3(7):76–83. doi: 10.25140/2410-9576-2017-1-2(10)-70-76.
44. Simopoulos A. P. (1991). Omega-3 fatty acids in health and disease and in growth and development. *The American journal of clinical nutrition*; 54(3), 438–463. doi:10.1093/ajcn/54.3.438.
45. Stabler S. P. (2013). Clinical practice. Vitamin B12 deficiency. *The New England journal of medicine*; 368(2):149–160. doi:10.1056/NEJMcp1113996.
46. Tatoli R., Caterina B., Donghia R., Pesole P. L., Fontana L., & Giannelli G. (2025). Dietary Omega-3 Fatty Acids from Fish and Risk of Metabolic Dysfunction-Associated Steatotic Liver Disease in a Mediterranean Population: Findings from the NUTRIHEP Cohort. *Nutrients*; 17(21):3372. doi:10.3390/nu17213372.
47. Trofymchuk A., Grinevich N., Trofymchuk M., Kunovsky Y., Bondar O., Tkachenko O., & Savchuk O. The state of the fish farming industry and its development trends in Ukraine and the world. «*Animal Husbandry Products Production and Processing*»; 2:123–133. doi: 10.33245/2310-9289-2021-166-2-123-133.
48. Tufail T., Bader U. I., Ain H., Ashraf J., Mahmood S., Noreen S., Ijaz A., Ikram A., Arshad M. T., & Abdullahi M. A. (2025). Bioactive Compounds in Seafood: Implications for Health and Nutrition. *Food science & nutrition*; 13(4):e70181. doi:10.1002/fsn3.70181.
49. Turunen A. W., Julia A., Suominen A. L., Männistö S., Marniemi J., Kiviranta H., Tiittanen P., Karanko H., Moilanen L., Nieminen M. S., Kesäniemi Y. A., Kähönen M., & Verkasalo P. K. (2013). Fish consumption, omega-3 fatty acids, and environmental contaminants in relation to low-grade inflammation and early atherosclerosis. *Environmental research*; 120:43–54. doi:10.1016/j.envres.2012.09.007.
50. Underwood B. A., & Arthur P. (1996). The contribution of vitamin A to public health. *FASEB journal : official publication of the Federation of American Societies for Experimental Biology*; 10(9):1040–1048.
51. Zimmermann M. B. (2009). Iodine deficiency. *Endocrine Reviews*; 30(4):376–408. doi:10.1210/er.2009-0011.
52. Zou J., Chen Z., Zheng F., Cao X., Zhao Y., Panerat S., Gao J., & Wang Q. (2025). Glycogenic hepatopathy in a primitive teleost fish model: the inductive effect of high carbohydrate diet and the alleviating role of betaine. *Marine life science & technology*; 8(1), 129–143. doi:10.1007/s42995-025-00301-0.

Біохімічний склад риби як джерело біологічно активних сполук та його роль у профілактиці кардіометаболічних порушень

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Резюме. Риба є одним із найцінніших продуктів харчування завдяки унікальному поєднанню макро- та мікронутрієнтів, які сприяють підтриманню життєвоважливих функцій організму людини і тварини. У структурі рибного м'яса білки становлять основний компонент, який забезпечує розвиток і відновлення тканин, підтримку м'язової маси та функціонування імунної системи. Ліпіди риби, особливо довголанцюгові поліненасичені жирні

кислоти омега-3, виконують енергетичну, структурну та регуляторну роль, беручи участь у синтезі біологічно активних сполук, регуляції обміну ліпідів та підтримці серцево-судинної системи. Значна частина цих жирних кислот, таких як ейкозапентаєнова (EPA) та докозагексаєнова (DHA), є біологічно активними компонентами, які сприяють розвитку нервової системи, нормалізації функції серця та профілактиці запальних процесів. Особливу увагу приділено вмісту мінералів і вітамінів у рибі, які характеризуються високою біодоступністю. Кальцій, фосфор, залізо, цинк, селен та йод відіграють ключову роль у формуванні кісткової тканини, функціонуванні нервової системи та обміні речовин. Жиророзчинні вітаміни A, D₃ та E забезпечують розвиток, антиоксидантний захист і регуляцію мінерального обміну, тоді як водорозчинні вітаміни групи B підтримують енергетичний обмін, синтез нейротрансмітерів та кровотворення. Комплексний вплив цих компонентів робить рибу ефективним елементом профілактики хронічних захворювань, включаючи серцево-судинні патології, остеопороз, анемію та нейродегенеративні розлади. Дослідження показують, що харчова цінність риби значною мірою залежить від виду, умов утримання, віку та характеру живлення риби. Жирні види морської риби містять більшу кількість омега-3 кислот, тоді як дрібні види, що споживаються цілими, забезпечують оптимальне надходження кальцію та інших мінералів. Нежирні види риби відзначаються високим вмістом білку та мінеральних речовин, що робить їх важливими для збалансованого харчування. Підкреслюється також роль риби у період вагітності та лактації, оскільки надходження довголанцюгових омега-3 кислот і вітамінів у цей період критично важливе для розвитку нервової системи плода та новонародженого. Висновки роботи акцентують увагу на необхідності систематичного вивчення харчової цінності різних видів риби, зокрема локальних і комерційних ресурсів, а також на перспективі інтеграції риби у національні програми здорового харчування. Перспективи подальших досліджень включають оцінку впливу технологій обробки на збереження поживних речовин, визначення оптимальної частоти споживання риби для різних груп населення, вивчення потенціалу аквакультури як джерела білку та мікронутрієнтів, а також міждисциплінарні дослідження впливу риби на фізіологічні, метаболічні та когнітивні показники здоров'я людини. Таким чином, риба виступає не лише харчовим продуктом, а й функціональною їжею, здатною позитивно впливати на стан здоров'я населення, підтримуючи нормальний розвиток і функціонування серцево-судинної, нервової, кровотворної, імунної та ендокринної систем. Регулярне включення риби до раціону є важливим кроком у формуванні збалансованого харчування та профілактиці широкого спектра хронічних і метаболічних захворювань.

Ключові слова: аквакультура, біохімічний склад, м'ясо риби, високоякісні білки, поліненасичені жирні кислоти омега-3, нутритивна цінність, серцево-судинна система

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