NUTRITIONAL PATTERNS AND NUTRITION OF AQUATIC ORGANISMS

Nurmatova Rukhsora Utkir kizi
Student of branch of Astrakhan State Technical University in Tashkent region

Annotation: ***The nutrition of hydrobionts can be autotrophic, heterotrophic and mixotrophic - when autotrophic organisms use ready-made organic matter to varying degrees (for example, many blue-greens). Among heterotrophs, a distinction is made between phagotrophs, which feed on living organisms or particles of organic matter, and saprophytes (osmotrophs), which absorb decay products of organic matter and metabolites of other organisms and feed primarily osmotically.***

Saprotrophy is most characteristic of fungi and heterotrophic bacteria, however, osmotic nutrition to one degree or another is characteristic of almost all hydrobionts. Autotrophic nutrition occurs in the form of phototrophy and chemosynthesis. Phototrophs include photosynthetic plants and bacteria, photoreducing microorganisms, as well as bacteria that reduce various organic substances using light energy. It is especially difficult to classify the forms of nutrition in bacteria, in which energy and constructive metabolism are not combined into one mechanism and are, to one degree or another, independent of each other. Among autotrophic bacteria, chemolitho-, photolitho- and chemororganoautotrophs are distinguished. They all use CO2 as a carbon source to build the body, but differ in how they produce energy. Chemolithoautotrophs (nitrifying, hydrogen, colorless sulfur, some thionic, methane-forming and iron-oxidizing bacteria) use the energy of oxidation or other reduced substances. Photolithoautotrophs (cyanobacteria, green, purple and sulfur bacteria) use the energy of sunlight, and chemoorganoautotrophs use the energy of oxidation of methanol, oxalates and other organic substances. Heterotrophic bacteria, including chemolitho-, chemoorgano- and photoorganoheterotrophs, use carbon, mainly from organic compounds, for constructive metabolism. In hemolithoheterotrophs (sulfate-reducing, some methane-forming, thionic bacteria, etc.), energy is obtained through the oxidation of H2 and S2O32- with the corresponding reduction of SO42- and O2. Chemoorganoheterotrophs (most aerobic microorganisms, anaerobic denitrifying bacteria, some colorless sulfur bacteria, etc.) produce energy by oxidizing various organic substances; photo organoheterotrophs (purple bacteria without sulfur) use light energy. The food of heterotrophic hydrobionts is mainly living or dead organisms, as well as the products of their decomposition and vital activity. In relation to individual types of aquatic organisms, the range of possible food sources narrows, since not every organic substance has all the qualities necessary to feed individual consumers. Food products, first of all, must be complete in their chemical composition, that is, contain all the elements and important compounds necessary for the consumer. The low chemical composition of some foods can be compensated by eating others that contain something that is not present in the former. The content of all the necessary chemical components in a food product does not make it a complete food: the body must be able to absorb the chemicals contained in it, that is, digestion is achieved, provided by the appropriate enzymes. Food products that are chemically complete and easily digestible may be difficult to identify in some cases, in others due to availability, speed of movement or other characteristics, and may still not satisfy the consumer. . In some cases, food is not used due to lack of energy. Obviously, the consumption of such an object is biologically unprofitable if more energy is spent on obtaining and digesting food than the digestible substance. Therefore, not only the total amount of food is important, but also the level of its accumulation. For example, in the Rybinsk Reservoir, the amount of available food for benthophagous fish is sufficient,

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but it is so dispersed that it does not satisfy the nutritional needs of the fish. Whales cannot feed on crustaceans in concentrations below 2 g/m3, otherwise the cost of movement will be higher than the energy expenditure.

In the overwhelming majority of cases, the nutrition of aquatic animals occurs exogenously and much less often – endogenously, when food does not come from the external environment. The larvae of many invertebrates and fish are characterized by a mixed diet, in which, for a certain period of time, the juveniles feed on the remainder of the yolk and by capturing food from the outside. In its typical form, endogenous nutrition occurs through the use of substances from one's own body. It is regularly carried out throughout the life cycle of many aquatic organisms, for example, during wintering, summer hibernation, during certain types of migrations and in a number of other cases of physiological shutdown of external power. A similar picture is observed in the absence or lack of food. By the time of a break in external nutrition, hydrobionts accumulate a large amount of reserve substances, primarily fat, as the most energy-intensive, stable and neutral component of the body. As a rule, animals that receive food regularly (for example, filter feeders) are able to fast for less time than those that feed occasionally. Many hydrobionts often feed endogenously at the expense of endo-symbionts-autotrophs (usually green and pyrophytic algae, cyanobacteria, armored flagellates, chemosynthetic bacteria), settling in the cells or other structures of their hosts. This kind of symbiotrophic nutrition is found in a number of ciliates and foraminifera, sponges, hydroids, siphonophores, scyphojellyfish, corals, ciliated worms, nudibranchs, bivalves and gastropods, and ascidians. The contribution of autotrophic endosymbionts to host nutrition varies. For example, sponges lacking zoochlorella grew 60-80% weaker than individuals with symbionts. In a number of Hawaiian corals, energy metabolism is provided by 60-70% of zooxanthellae. Ascidians with symbionts in the light include 4-5 times more labeled CO_2 in the tissue than in the dark.

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