Functional Properties of Marine Oligopeptides and Their Preparation Methods

Yixian Li*
China Jiliang University, Hangzhou 310018, China. E-mail: 1311647205@qq.com

Abstract: The research of marine biooligopeptides has been regarded as a dark horse in the field of resource exploitation due to the development of various technologies in recent years. Its appearance brings a visible development prospect to the basic research field of medical health cosmetics science. Starting with the basic research of marine polypeptides, this paper expounds the characteristics, operation mechanism and existing preparation methods of marine polypeptides.

Keywords: Oligopeptides; Marine Biological Oligopeptide; Physiological Function; Preparation Method

In recent years, with the improvement of people’s quality of life, people’s demand for high-quality protein and other nutrients is also increasing year by year, and the polypeptide species on the land has been unable to meet such a high demand. Covering 70% of the earth’s surface, the oceans have many resources that people can use, so marine organisms have been the source of new peptide metabolites. With the application of modern biological and food technology in various researches, the development of marine biological oligopeptide is becoming a hot spot in the development of the ocean.

1. Marine oligodendropeptides

Biooligopeptide is a kind of polypeptide substance extracted from animals, plants, microorganisms and their metabolites. Molecular weight segment is generally less than 1000 Dalton, also known as small peptide, oligopeptide or known as small molecule active peptide, it generally consists of 4 to 10 amino acids.

More than 100 years ago, Matthews discovered that peptides absorb and operate differently from amino acids. Agar was firstly found that the intestinal tract can transport dipeptide completely. Newey and Smith found evidence that the peptide can be completely transported. In the 1980s, it was found that only low levels of protein and synthetic amino acid supplementation were fed, livestock and poultry cannot achieve the best growth performance and feed conversion efficiency\(^\text{[1]}\). The reverse proves that the peptide can be operated directly, and it plays an important role in nutrient absorption of animals and plants. These peptides can directly participate in the regulation of digestive metabolism and endocrine, and studies have shown that all biological functional peptides may be found in the form of short peptides.

Although the mechanism of oligopeptide transport in the body is not fully understood, Zou Yuandong, a world-renowned expert on enzymatic polypeptides, has pointed out that these three transport mechanisms can now be demonstrated: (1) Exchange transfer system of H\(^+\) or Na\(^+\), which relies on PH without dissipating ATP; (2) Active transport that relies on H\(^+\) or Ca\(^{2+}\) concentration gradient and dissipating ATP; (3) The system of glutathione (GSH)\(^\text{[2]}\).
Marine biological oligopeptide is a class of peptides derived from marine animals, plants and microorganisms and their metabolites. Its absorption mechanism is superior to amino acids and it has special physiological functions that cannot be replaced by amino acids and other macromolecules. It has the characteristic of preferential fast 100% absorption, it is not digested by the human body and does not consume human energy to promote the body absorption with their own energy. It can be used as a carrier to transport other nutrients to human cells and tissues, promoting the absorption of substances. The existing biological oligopeptides are mainly derived from terrestrial plants and animals. However, due to high salinity, high pressure, hypoxia and dark and other special growth environment, the development of oligopeptides in marine organisms is less. The biosynthetic pathway and enzyme reaction system of its secondary metabolites are very different from those of terrestrial organisms, and it makes the active substances produced by marine organisms have novel chemical structures and various biological activities, among which peptides account for the majority. Therefore, these peptides have great potential in the research and development of genetically engineered drugs.

2. Functional properties of oligopeptide in marine organisms

2.1 Promoting nutrient absorption and synthesis

Many biopeptides act as many mineral elements. In particular, Ca2+ is a carrier transported in vivo, casein phosphopeptides (CPP), for example, are the most mineral-binding peptides available today. The mechanism is that the center contains phosphorylated serine groups and glutamyl residues; it can combine with minerals to form complexes, enhance the solubility of minerals, and promote its absorption. And in the medical field, for patients with poor digestion and absorption, edible peptides or proteolytic formula food, it can also be used as a dietary enhancer and medicine to supplement the nitrogen source.

2.2 Promoting hormone secretion

Hormones are chemical information substances synthesized by endocrine cells in the body and transported through the blood, and play a special physiological role, such as maintaining metabolic balance. Cell division and differentiation are promoted, and the normal growth and development of reproductive organs mature aging and reproductive process and the nervous system and its activities are affected. Marine organism oligopeptide can be absorbed by the cells of corresponding organs in human body, which affects the growth and metabolism of hormone synthesis cells, and promotes the secretion of hormone.

Studies have found that the neuropeptides in the opioid active peptides such as enkephalin and other neuroactive peptides, for example, growth hormone inhibitors, bradykinin and thyrotropin releasing hormone. It interacts with μ, δ, γ-receptors in the human body as a hormone and neurotransmitter, which relieves pain and regulates respiration and body temperature.

2.3 Promoting growth

It is mainly due to the promoting of growth hormone secretion and the absorption of nutrients to realize the proliferation and differentiation of cells. The growth and reproduction speed of individuals is accelerated, resulting in the growth of the overall number of cells. It can be used as a late treatment for some patients undergoing resection and has a great effect on accelerating the rate of microbial reproduction and passage in basic research.

2.4 Immunocompetence

The human immune system is divided into three lines of defense. Oligopeptides mainly affect the synthesis of antibacterial substances in the second and third lines of defense, such as phagocytic cell-specific lymphocytes and antibodies. The immune system of the human body has a great role in promoting, can effectively improve the human immunity.

Immuoactive peptide is the second discovered bioactive peptide and the first discovered bioactive peptide in human milk protein. Recent studies have found that endorphins in opioid peptides such as enkephalins and strong enkephalins regulate the immune system. Mainly because the beta-endorphins bind to the beta-endorphin receptors on immune cells, it can promote the antibody synthesis of lymphocytes and the proliferation of natural killer cells (NK cells) and phagocytosis of
macrophages. When its concentration is low, it promotes the human immune function; when the concentration is too high, the immune function of human body is suppressed\[7\]. At the same time, inhibition of osmotic pressure can also be achieved by promoting cell acid production and inhibiting cell wall formation, synergism and synergism with immune cells. In addition, it also regulates body functions, such as inhibiting the angiotensin-converting enzyme to control the renin-angiotensin system (RAS) regulating blood pressure\[8\].

2.5 Antioxidant

Oxidation is the most common life, and its principle is involved in metal ions. Oligopeptides can capture metal ions and promote the degradation of peroxides. At the same time, it can also inhibit fat oxidation catalyzed by iron heme lipoygenase and singlet oxygen in vitro\[9\], which can reduce the natural oxidation rate, the content of hydrogen peroxide and free radical in fat and the occurrence of oxidation reaction. Therefore, antioxidant peptides are also known as heavy metals and hydrogen peroxide scavengers. It has also been found that high-F-value oligopeptide of barbaulus japonicus can eliminate the excess reactive oxygen species (ROS) in the body by increasing the activity of antioxidant enzymes and play the role of anti-fatigue and antialcoholism\[10\].

2.6 Antineoplastic

The imbalance between cell proliferation and apoptosis is suppressed, which may lead to tumor formation. Sun Yu et al.\[11\] found that the synthetic oligopeptide of philippinarum has a significant effect on inhibiting the proliferation and inducing cell apoptosis of cancer cells.

Studies have shown that tumor antigens bind to the major histocompatibility complex molecules, which are presented to the cell surface for identification by the corresponding T cells. Thus, we can identify tumor cells and introduce the foreign gene into tumor cells as a vaccine to activate or enhance the body’s anti-tumor immune response. This has the potential to be a new approach to immunotherapy for cancer, and to make tumor therapy truly move towards specific stage T cell therapy\[12\].

3. Existing methods for preparing marine biological oligopeptides

3.1 Enzymolysis approach

As the precursors of small biological molecules such as amino acids and oligopeptides, direct hydrolysis is the most convenient and effective way to obtain proteins. Proteolytic hydrolysis is divided into chemical hydrolysis and enzymatic hydrolysis. As for chemical method, because of the use of acid or base protein peptide bond break, reaction environment is too extreme, and it is difficult to ensure the oligopeptide alive. However, the active peptide produced by enzymatic hydrolysis was safe and easy to control under mild conditions\[13\]. Therefore, enzymatic hydrolysis is widely used in production and research. Enzymatic production process of active peptide generally has five processes of selecting raw material protein pretreatment, enzymatic hydrolysis, separation and purification of finished products.

3.2 Synthesis method

There are three main methods to synthesize bioactive peptides: chemical synthesis, enzymatic synthesis and recombinant DNA technique. Recombinant DNA technology can only synthesize macromolecular peptides and proteins. The chemical reagents used in chemical synthesis have a great impact on the human body and the environment, and the scope of application is limited to the field of experimental medicine. However, the enzymatic synthesis method is often used because of its mild reaction and directivity of enzymatic location\[14\]. The development of marine life is not limited to these. There are still a lot of knowledge that we can learn from the ocean, and the application of various aspects of marine biological oligopeptide and the effective extraction technology still need to be developed and studied.

4. Research prospects

As a country with abundant marine resources, the application of oligopeptide in marine organisms has been studied. At present, great achievements have been made in the application of marine oligopeptides to the production of blood pressure lowering peptides with antioxidant activity peptides. Other marine bioactive peptides, such as antitumor active peptides, high-F-value oligopeptides and immunoactive peptides, due to the restriction of enzymatic application of separation and purification tech-
ology, have not been better developed and utilized. Therefore, the research and application of marine oligo-
peptides remain to be explored by human beings.

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