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Introduction

Food-derived functional peptides are bioactive molecules obtained from dietary proteins, which exist in food proteins through specific amino acid sequences. Upon protein degradation, these peptides are released and acquire physiological activity during the process. With abundant natural protein resources and industrial scalability, food-derived peptides have gained significant attention due to their high safety profile.

Recent scientific advancements have revealed that these bioactive peptides, as functional fragments of proteins, not only supply essential nutrients for growth and development but also exhibit unique physiological characteristics compared to intact proteins:

1) **Enhanced bioavailability**: Food-derived peptides demonstrate superior absorption efficiency with low or no antigenicity. Current research indicates that small peptides (2–3 amino acids) can be directly absorbed into the circulatory system without further digestion or energy expenditure. Their absorption, transformation, and utilization processes are both efficient and complete. Compared to proteins, peptides have shorter residence times in the body, minimizing contact with antibody-producing cells and reducing immune stimulation.
2) **High biological activity**: These peptides exhibit potent effects even at low concentrations. Their actions span multiple biological levels, from cellular processes to tissue and organ functions.
3) **Structural modifiability**: The molecular structure of food-derived peptides is easily amenable to chemical modifications and resynthesis for targeted functional development.
4) **Nutritional balance regulation**: Unlike excessive protein intake, these peptides effectively regulate metabolic balance without causing nutrient overload.

In biological systems, endogenous peptides are essential for normal physiological functions. Bioactive peptides (or functional peptides) are defined as compounds formed by two or more α-amino acids linked through peptide bonds. The diverse biological structures and functions of peptides arise from variations in amino acid composition, quantity, and sequence arrangement. Based on their origin, peptides can be classified as endogenous (naturally produced within organisms) or exogenous (dietary-derived).

Food-Derived Bioactive Peptides: Green Preparation, Activity Mechanisms, and Health Applications, First Edition. Shao-Yun Wang, Xu Chen, and Xixi Cai.

Extensive research has characterized food proteins as a rich source of functional peptides. These peptides demonstrate a wide range of biological activities, including antihypertensive effects (e.g., ACE inhibition by soy peptides), antioxidant properties (e.g., wheat germ peptides), anticancer potential (e.g., marine peptides), anti-inflammatory actions (e.g., casein-derived peptides), immune modulation (e.g., immunostimulatory peptides from egg proteins), and cholesterol-lowering capabilities (e.g., oat peptides).

As highlighted in recent studies (e.g., Food & Fermentation Industries 2024), these bioactive peptides represent promising therapeutic agents for human health. Their application in the food industry as functional ingredients offers significant potential for improving consumer health outcomes, particularly in addressing chronic metabolic disorders and enhancing nutritional status across diverse populations. Current research emphasizes their role in precision nutrition and personalized dietary interventions, aligning with the growing demand for science-based functional foods.

The *Handbook of Foodborne Bioactive Peptides* offers a comprehensive overview of bioactive peptides. This volume focuses on the source, preparation, activity evaluation, mechanism consideration, and practical application, as well as the classifications of major bioactive peptides such as antifreeze peptides, antioxidant peptides, antimicrobial peptides, metal chelate peptides, antiaging peptides, antifatigue peptides, immune regulatory peptides, flavor peptides, and self-assembling peptides. Moreover, the new technology, future research direction, and emphasis of functional peptides were summarized.