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Opinion Article

Mechanisms and Functional Properties of Bioactive Peptides in Food Production

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DESCRIPTION

Food derived peptides must appear as significant bioactive compounds with a multitude of health-promoting benefits and functional attributes. These peptides, generated through enzymatic hydrolysis, fermentation, biotechnological approaches, and in silicon prediction, have garnered substantial attention in recent years due to their potential therapeutic and functional properties. The intricate interplay between production strategies, action mechanisms, and structure-functional attributes defines the scope of their applications across various sectors of the food and pharmaceutical industries. Production strategies for food-derived peptides encompass a range of methods aimed at liberating these biologically active compounds from their parent proteins.

Enzymatic hydrolysis, a conventional approach, services proteases to cleave proteins into peptides with specific amino acid sequences. This controlled degradation leads to the release of peptides with targeted bioactivities. Fermentation, an age-old technique, leverages microorganisms to enzymatically degrade proteins, yielding peptides with enhanced digestibility and health benefits. Biotechnological methods, including genetic engineering and recombinant protein expression, offer the opportunity to produce peptides with desired functionalities that may be challenging to obtain through traditional approaches. Moreover, bioinformatics and in silicon prediction have paved the way for precise identification and selection of potential bioactive peptides from protein sequences, revolutionizing the detection process.

The multi-layered action mechanisms of food derived peptides underscore their diverse range of functional attributes. Antioxidant activity, a widely studied mechanism, involves the scavenging of free radicals, mitigating oxidative stress, and potentially reducing the risk of chronic diseases. Antihypertensive effects are exhibited by peptides that inhibit Angiotensin Converting Enzyme (ACE), leading to blood pressure regulation. These peptides hold potential as natural alternatives for managing hypertension. The antimicrobial properties of food-derived peptides contribute to food safety and preservation, and they may also find applications in combating microbial infections.

Immunomodulatory peptides interact with immune cells, potentially enhancing immune responses and supporting overall health. Opioid peptides, resembling endogenous opioids, influence neural pathways and physiological processes, influencing mood, pain perception, and satiety. These intricate action mechanisms collectively underline the potential of food-derived peptides in preventive and therapeutic health interventions. The structure-functional attributes of food-derived peptides play a pivotal role in their bioactivity and physiological effects. The peptide's length, sequence, and composition significantly impact its interaction with target molecules and receptors. Secondary structures, such as α-helices and β-sheets, influence binding capabilities and enzyme interactions.

Charge and hydrophobicity order solubility, stability, and membrane interactions, affecting bioavailability and cellular uptake. Molecular weight influences absorption, distribution, metabolism, and excretion properties, significant for evaluating bioactivity. The three-dimensional conformation of peptides determines their ability to bind to receptors and enzymes, subsequently influencing their physiological responses. The intricate interplay of these structural attributes defines the peptide's potential applications and efficacy.

In practice, the applications of food-derived peptides span across diverse sectors, reflecting their immense potential. Functional foods and nutraceuticals capitalize on the health benefits of peptides, offering customized solutions for cardiovascular health, gut modulation, and immune support. Incorporating peptides into food formulations elevates product functionality, expanding their use in bioactive food ingredients. The pharmaceutical industry recognizes the potential of food-derived peptides as lead compounds for drug development, potentially addressing a spectrum of health conditions. Personalized nutrition, an

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Mechanisms peptides to create customized dietary interventions based on individual health profiles.

Moreover, the utilization of food-derived peptides aligns with sustainability efforts, as they can be produced from by-products and waste materials, reducing food waste and supporting circular economy principles the exploration of production strategies, action mechanisms, and structure-functional attributes of food-derived peptides has unveiled a realm of possibilities at the nexus of nutrition, health, and food science. These peptides, obtained through enzymatic hydrolysis, fermentation, biotechnological methods, and computational prediction, exhibit a diverse range of health-promoting mechanisms.