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Bioactive Peptides derived from Different Source of Food and Roles

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Bioactive Peptides are defined as specific protein fragments that have a positive impact on body functions or conditions and may influence health. Bioactive peptides are derived from food proteins and exert a positive effect in humans due to its health-promoting properties. Bioactive peptides can exert several beneficial effects like preventing diseases or modulating the physiological systems once they are absorbed in the human body. There is a broad range of functions, depending on the sequence of the bioactive peptides, so that they can be involved in the gastrointestinal system such as the anti-obesity and satiety peptides, the cardiovascular system such as antihypertensive, antithrombotic, antioxidant and hypocholesterolemic peptides, the immune system such as antimicrobial, cytomodulatory and immune-modulatory peptides, and the nervous system such as opioid peptides. Bioactive Peptides also play important roles in the metabolic functions of living organisms and, consequently, in human health. These Peptides can be classified based on their mode of action as antimicrobial, anti-thrombotic, antihypertensive, opioid, immunomodulatory, mineral binding, and antioxidative. Bioactive peptides usually contain 3 – 20 amino acid residues per molecule and remain inactive when the sequence present in the parent protein. They convert in active for once they released by the enzymatic hydrolysis of protein molecule by using peptidases during food processing and gastrointestinal digestion. Bioactive peptides have been considered the new generation of biologically active regulators that can prevent, for example, oxidation and microbial degradation in foods. They can be used for the treatment of various medical conditions, thus increasing the quality of life.

Method of production of Bioactive Peptide

There are a number of methods by which peptides with biological activity can be produced from precursor proteins. The most common ones are (a) enzymatic hydrolysis with digestive enzymes, (b) by means of the microbial activity of fermented foods (c) through the action of enzymes derived from proteolytic micro-organisms. Once the structure of bioactive peptides is known, it is also possible to synthesize peptides. Three main approaches are available at present: (1) chemical synthesis; (2) recombinant DNA technology; and (3) enzymatic synthesis

Among the all production methods, enzymatic hydrolysis of proteins has been the most common way to produce bioactive peptides. Pancreatic enzymes, preferably trypsin, have been used for the chemical characterisation and identification of many known bioactive peptides. For example, ACE-inhibitory peptides as well as CPPs are most commonly produced by trypsin. On the other hand, other enzymes and different enzyme combinations of proteinases—including alcalase, chymotrypsin, pancreatin and pepsin as well as enzymes from bacterial and fungal sources—have been utilised to generate bioactive peptides. Microbial enzymes have also been successfully used to generate ACE-inhibitory peptides.

Peptides derived from other than milk proteins have been successfully produced by thermolysin and trypsin. Several hypotensive peptides have been identified from porcine skeletal muscle and corn protein after digestion with thermolysin.

Source of Bioactive Peptide

Among the macronutrients present in foods, peptides and proteins are of paramount importance, because they supply the required raw materials for protein biosynthesis and represent a source of energy. Also, they are part of an intricate series of organic transformations that occur during the processing and storage of foods that ultimately contribute to their sensory characteristics. In addition to their nutritional value, food proteins, and peptides exhibit distinct biological activities. Bioactive Peptides are predominantly encrypted inside bioactive proteins. By far, bovine milk (cheese), and dairy products are the greatest sources of bioactive proteins and peptides derived from foods. However, they can also be obtained from other animal sources such as bovine blood, gelatin, meat, eggs, and various fish species such as tuna, sardine, herring and salmon. Some vegetal sources of Bioactive Peptides are wheat maize, soy, rice mushrooms, pumpkin, sorghum, and amaranth. *In vivo*, encrypted peptides can be liberated during gastrointestinal (GI) digestion by enzymes such as trypsin or by microbial enzymes. *In vitro*, Bioactive Peptides can also be released during food processing or ripening by microbial enzymes (e.g. *Lactobacillus helveticus*). Bioactive Peptides have been identified and isolated from animal and vegetal sources and are abundantly present in protein hydrolysates and fermented dairy products.

Classification of Bioactive Peptides Based on functional properties

ACE Inhibitory Activity Peptides: These peptides are inhibitors of the angiotensin-1 converting enzyme (ACE or ACE-1) and can thus prevent hypertension. ACE has a relevant role in the regulation of blood pressure in the renin-angiotensin system because this enzyme converts the inactive decapeptide angiotensin I into the potent vasoconstricting octapeptide angiotensin II and this results in an increase in blood pressure, such enzyme is also able to inactivate bradykinin. So, ACE inhibitory peptides can reduce the blood pressure a few hours after oral administration through the inhibition of ACE that is a dipeptidyl carboxypeptidase usually membrane-bound in vascular endothelial cells.

Opioid Peptides: Opioid peptides have a good affinity for an opioid receptor and are thus able to exert opiate-like effects by affecting the nerve system and gastrointestinal functions. Peptides from exogenous sources are denominated exorphins. The stability and lower side effects are the main advantages of food derived opioid peptides when compared to endogenous and synthetic opioid peptides. Such peptides are usually characterized by a tyrosine residue at the amino terminal end and an aromatic residue located in the third or fourth position. Exorphins have been reported in hydrolysates from milk casein, wheat gluten and blood haemoglobin.

Antioxidant Peptides: Depending on the chemical reactions involved, antioxidant activity of peptides can be classified into two groups: i) those peptides able to reduce free radicals by hydrogen donation in a competitive reaction, and ii) those peptides able to transfer one electron to reduce an oxidant. The methods used in the first case are oxygen radical absorbance capacity assay (ORAC), total radical trapping antioxidant parameter (TRAP) and b-carotene bleaching assay, while in the second case are 2,20-azino-bis(3-ethylbenzthiazoline6-sulfonic acid (ABTS) radical scavenging assay, ferric-reducing antioxidant power, and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity.

Peptides against Type-2 Diabetes: Type-2 diabetes affects millions of adults worldwide constituting a major health issue. Over nutrition and obesity have a clear incidence on the development of diabetes type-2. Certain bioactive peptides have been reported to enhance

insulin sensitivity and activate AMP-activated protein kinase via multiple signaling pathways. The enzymes a-glucosidase and dipeptidyl dipeptidase IV (DPPIV) are somehow regulating the glucose levels in postprandial plasma. So, an effective strategy to manage diabetes type-2 would be based on the inhibition of both enzymes. Dipeptidyl peptidase IV is a serine protease able to cleave preferentially X-proline or X-alanine dipeptides from the N-terminus of different substrates and its inhibition would reduce its action on glucagon-like peptide (GLP-1) and glucose-dependent insulinotropic peptide (GIP).

Future Aspects of Bioactive Peptides

The occurrence of many biologically active peptides in dietary proteins is now well-established. Numerous scientific, technological and regulatory issues have, however, to be resolved before these substances can be optimally exploited for human nutrition and health. First of all there is a need to develop novel technologies by which active peptide fractions can be produced and enriched. Secondly, it is important to study the technological properties of the active peptide fractions and to develop model foods which contain these peptides and retain their activity for a certain period. It is recognized that peptides can be more reactive than proteins, due to their lower molecular weight, and the peptides that are present in the food matrix may react with other food components.