Chapter 30
Pro-/Anti-Inflammatory Bioactive Proteins and Peptides

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ABSTRACT

Bioactive peptides (BP) are specific protein fragments that can affect biological processes or substrates that have a positive impact on functions and conditions on body health. Plant and animal sources that contain physiologically active food proteins, native or processed, are rich sources of bioactive peptides. Bioactive peptides derived from food proteins have been demostrated to have variety of beneficial effects, such as anti-inflammatory and antioxidant properties. BP are accepted the new generation of biologically active regulators; they can prevent oxidation and microbial degradation in foods and furthermore improve quality of life by treating various diseases and disorders. The present review highlights the recent findings on the roles of various food-derived bioactive peptides in inflammation and oxidative stress and discuss the potential benefits and limitations of using these compounds against the burden of chronic diseases.

BACKGROUND

While proteins were just considered as a source of energy and essential nutrient for the body and the health of human, after the discovery and characterisation of proteolytic enzymes, there was generation of protein hydrolysates by means of such enzymes. Protein hydrolysates are defined as complex mixtures of oligopeptides, peptides, and free amino acids that are produced by partial or extensive hydrolysis. Peptides, and free amino acids, are more readily absorbed in the digestive tract when compared to native proteins (García & Manrique, 2019). Recent scientific evidence of research has revealed that many food proteins and peptides exhibit specific biological activities in addition to their established nutritional value (Mine & Shahidi, 2006; Hartmann & Meisel, 2007; Moller, Scholz-Ahrens, Roos, & Schrezenmeir, 2008; Mine, Li-Chan, & Jiang, 2010).

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There are many examples of biologically active food proteins with physiological importance that go beyond pure nutritional requirements that concern the available nitrogen for normal growth and development (Kitts & Weiler, 2003).

Bioactive Peptides (BP) (Sharma, Singh, & Rana, 2011; Walther & Sieber, 2011) have been defined as specific protein fragments that can affect biological processes or substrates that have a positive impact on functions and conditions on body health (Kitts & Weiler, 2003; Sánchez & Vazquez, 2017). It is considered as "bioactive" if a dietary component imparts a measurable biological effect at a physiologically realistic level and if it is measured as "bioactivity", it has to have the potential (at least) to affect health in a beneficial way (Schrezenmeir, Korhonen, Williams, Gill, & Shah, 2000; Moller et al., 2008; Moughan & Rutherfurd-Markwick, 2013). Plant and animal sources that contain physiologically active food proteins, native or processed, are rich sources of bioactive peptides (Yoshikawa et al., 2000; Chakrabarti, Jahandideh & Wu, 2014; Malaguti, Dinelli, Leoncini, Bregola, Bosi, Cicero, & Hrelia, 2014; Massaccesi, 2016; Moronta, 2016). BPs are predominantly encrypted inside bioactive proteins. Peptides obtained from proteins from all imaginable sources (vegetable, fungi, animal, or even bacteria in origin) have been generated and characterised based on their structure, functional properties, and the type of bioactivity (García & Manrique, 2019). In addition, there are many physiologically active peptides derived from protease activity from various food protein sources; however, the relationship between structural features and functional activities are not fully explained (Kitts & Weiler, 2003). By far, bovine milk (Torres-Llanez, Vallejo-Cordoba, & Gonzalez-Cordova, 2005; Korhonen & Pihlanto, 2006; Korhonen, 2009; Léonil, 2014; Mohanty, Mohapatra, Misra, & Sahu, 2016), cheese (Pritchard, Phillips & Kailasapathy, 2010), and dairy products (Choi, Sabikhi, Hassan & Anand, 2012), bovine blood (Przybylski, Firdaous, Châtaigné, Dhulster, & Nedjar, 2016), gelatin (Lassoued, Mora, Barkia, Aristoy, Nasri, & Toldra, 2015), meat, eggs, various fish species such as tuna, sardine, herring and salmon are the animal sources that the bioactive proteins and peptides are obtained. Some plant-based sources of BP and proteins are wheat (Kumagai, 2010), maize, soy (Singh, Vij & Hati, 2014), rice (Selamassakul, Laohakunjit, Kerdchoechuen, & Ratanakhanokchai, 2016), mushrooms, pumpkin, sorghum (corn, rice, barley, sunflowers, etc.) and amaranth (Wang & Gonzalez de Mejia, 2005; Silva-Sanchez, de la Rosa, Leon-Galvan, de Lumen, de Leon-Rodriguez & de Mejia, 2008). Currently, more than 1500 distinctive BP have been notified in a database named 'Biopep' (Singh et al., 2014; Sánchez & Vazquez, 2017).

It is reported that the bioactive peptides in the human body can be acquired from two distinctive sources: endogenous bioactive peptides (TEnBP) and exogenous bioactive peptides (ExBP). TEnBP and ExBP was found out to be major role in metabolism. The peptide body bindes to the recycling and reuse of macromolecules, especially proteins. Proteolytic activity, a omnipresent processing in the body, plays a key role in several physiological mechanism just as digestion of dietary proteins, proteolytic cleavage of N-terminal signalling consecutions, and activation of zymogens. Thereby, the idea has emerged that there is area for the body to benefit from proteins in addition to their primary functions, as cryptomic sources of bioactive peptides concern about the dynamic local and systemic environments (Dave, 2019). The biological functions of the peptides, in some instances, are subjected by a definite amino acid sequence, while in other instances, it bases on the relative rate of a particular amino acid or group of amino acids (Siebert, 2001). Just as the amino acid design, charge, hydrophobic properties, weight and length of the peptides, and type of residues at C- and N-terminals. All of these factors influence the functional properties and biological activities of a peptide (Li, He, & Qian, 2011; Bhat, Kumar, & Bhat, 2015; Rizzello, Tagliazucchi, Babini, Sefora Rutella, Taneyo Saa, & Gianotti, 2016, Daliri, Oh, & Lee, 2017; Chalamaiah, Yu, & Wu, 2018; Guha & Majumder, 2018; Chalamaiah, Ulug, Hong, &