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Editorial

The Value of Immunochemistry to Food Science

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At present, the public is aware of the importance of a healthy well-balanced diet and it has never been more concerned about quality and safety of food products. Consequently, there is a growing demand for accurate and sensitive analytical methods able either to assess food authenticity or to check appropriateness of informative labelling or to detect contaminants potentially hazardous to the health. However, the development of methods for food analysis based on conventional techniques (e.g. gas chromatography, thin layer chromatography, high performance liquid chromatography, electrophoresis), is frequently hindered by the inherent complexity and variability of food matrices. Indeed, food products range from liquids and pastes to solids and powders and may contain a variety of differently processed ingredients. Furthermore, progress in food technology has led to an ongoing manufacture of new specialized products. Immunoassay technology has been exploited in food science since the early 1980s, both for research purposes, and, more significantly, for routine analysis. Actually, immunochemical methods had already been extensively used in medical research and clinical diagnostics, but originally they had poor impact on food science. This initial gap between medical and food research in developing immunoassays was most likely due to the fact that immunochemistry had evolved within clinical environments whereas food analysts were normally trained as chemists, and then they were not ready to appreciate fully the extraordinary potentiality of the analytical strategies based on the use of immunochemical means. Immunochemistry has proved to be particularly effective in food analysis in terms of performance (sensitivity, reproducibility, and reliability) and convenience (rapidity, cheapness, minimal sample clean-up, throughput, and reduced environmental impact). A wide variety of immunoassay formats and reagent configurations have been devised for analytical applications concerning food safety and quality assurance, ranging from detection of chemical contaminants, antibiotics, hidden allergens, pathogenic microorganisms and their toxins to monitoring levels of quality markers in food samples. Advantages of immunochemical methods arise primarily from the use of antibodies as reagents. Results are basically measurements of the extent of the antigen-antibody reaction, displaying the most striking features of molecular specificity in the biological world, along with the enzyme-substrate interaction and the hormone-receptor binding. Obviously, success in developing an immunoassay is heavily dependent on the binding specificity of the antibody preparation. Nowadays, highly selective and sensitive antibodies acting as real "smart reagents" can be obtained, mainly thanks to the technological advancements in monoclonal and antipeptide antibody production. Accordingly, a food analyte, present even in trace amounts, can be specifically recognized in either simple dilutions or rough extracts of food samples, whereas interferences from the food matrices are minimized.

The contribution of immunochemistry to analytical research addressing issues related to the authenticity of milk-derived products has been recently reviewed [1]. Detection of a specific molecular species in the protein component of milk and/or dairy products is generally a difficult task. Milk proteins are markedly microheterogeneous, because of the occurrence of genetic variability, discrete phosphorylation, glycation, and limited hydrolysis by native milk proteinases. In addition to residual native milk proteins, cheese includes a multitude of closely related peptides arising from the proteolysis of each milk protein. At last, single proteins and/or peptide components may be further modified by the technological processes applied to milk and employed for cheese-making. As reported in the review above mentioned, immunochemistry has provided suitable solutions to a number of analytical challenges presented by milk and cheese samples and fulfilled the major requirements for quality control of dairy products. Tailor-made antibodies have been developed either for the detection of single protein components or for recognizing protein adducts created by dairy processes, mostly using the antipeptide antibody technology [2]. Immunochemistry has also significantly contributed to identify the food proteins responsible for the IgE-mediated immune response in food allergy. Tipically, the proteins extracted from the allergenic food and separated by gel electrophoresis are allowed to react with sera from patients affected by IgE-mediated food allergy, used as the primary reagents. Protein bands linked to IgE are then immunostained with enzyme-labeled anti-human IgE polyclonal antibodies, used as the secondary reagent. By this procedure, bovine κ-casein has been selectively detected along the electrophoretic profile of milk proteins by IgE included in the serum of an adult atopic patient who had outgrown cow milk allergy in early childhood. According to the specificity displayed by IgE of the serum chosen, the glycosidic moiety of bovine κ-casein has proved to be principally involved in IgE recognition [3].

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