JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY

Symposium Introduction

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Food Bioactives Research and the *Journal of Agricultural and Food Chemistry*. Symposium Introduction

ABSTRACT: The bioactive compounds in foods have been the topic of many papers over the past 20 years and are among those that have received a higher citation in agriculture and food science journals. With the occasion of the 60th anniversary of the *Journal of Agricultural and Food Chemistry*, a Symposium on Food Bioactives was held during the 2011 American Chemical Society meeting in Denver, CO. The symposium was organized as an overview of the state of the art in knowledge of food bioactives and the perspectives and trends for the 21st century.

KEYWORDS: *food, health, biological activity, phytochemicals*

With the occasion of the 60th anniversary of the *Journal*, a Symposium on Food Bioactives was held during the 2011 American Chemical Society meeting in Denver, CO.

The bioactive compounds in food have been the topic of many articles published in the *Journal of Agricultural and Food Chemistry* over the past 20 years and are among those that have received a higher citation. Among the most relevant publications are those related to the evaluation of the antioxidant activity of different foods, the correlation with specific chemical constituents, particularly phenolic compounds, and the chemical aspects of the evaluation of the antioxidant activity. The studies of phenolics, tannins, fiber, carotenoids and other terpenoids, glucosinolates, etc. have been the objective of a good number of these papers. This has contributed to increasing the knowledge of the occurrence of relevant amounts of chemically diverse bioactives in different food products. The studies have pointed out specific food products that are relevant in the content or biological activity of the bioactives. These include berries, cocoa, wine, tea, coffee, pomegranate, soy, oranges, apples, grapes, olives and olive oil, vegetables, spices, etc. and have helped to increase the production and consumption of these healthy foods.

The ACS symposium in Denver was organized as an overview of the state of the art in knowledge of food bioactives and the perspectives and trends for the 21st century.

J. Seiber and L. Kleinschmidt reviewed the publication trends in the *Journal of Agricultural and Food Chemistry* and the changes that have occurred in the past years to move from interest in detrimental food constituents to beneficial ones.

B. Ames presented a perspective of the health risks and the role of food in decreasing the risk of specific diseases.

J. Finley et al. presented an interesting evolution of the research on food phenolics that has gradually changed from solving quality (color and flavor) problems produced by these compounds (browning, astringency, bitterness, etc.) to the health effects of these phenolics and their metabolites.

The health effects of food bioactives on cardiovascular diseases, cancer, and diabetes were covered in the symposium with different papers.

Cardiovascular effects of food bioactives have been associated with the improvement of plasma lipid profiles to decrease atherogenesis, anti-inflammatory effects, and control of blood pressure. In this sense the beneficial effects of almonds, which go beyond the improvements in atherogenic lipoprotein profile, were presented by O. Chen. The way different foods can mitigate inflammation was presented by A. Schauss and X. Wu and the hypotensive effects of high-antioxidant potatoes on hypertensive subjects by J. Vinson et al.

Cancer is often associated with dietary habits. This is particularly relevant in the gastrointestinal tract cancers, in which dietary fiber and other food bioactives can play a relevant role. In fact, the evaluation of the potential of food bioactives decreasing the risk and severity of cancer has been the objective of many studies, most of them using in vitro human cell models to evaluate the health benefits of food constituents. Establishing good animal models to study the development of cancer is an essential task. In this sense, K. Hintze et al. presented the formulation of the Total Western Diet as a basal diet for rodent cancer studies. S. Schwartz presented the relevance of phytochemical absorption and metabolism in food-based cancer prevention studies. The effect of broccoli sulforaphane in colon cancer was reviewed by E. Jeffery, and the role of dietary factors and phytochemicals in colon cancer risk was presented by R. MacDonald.

Obesity and type 2 diabetes have also received attention due to the potential effect of food bioactives in the prevention of diabetes. Tang et al. presented the hypoglycemic effects of stilbenoids in a diabetic mouse model and discussed the potential mechanisms for the observed effect.

Some food bioactives can show relevant effects reducing the risk of different diseases, as was the case of 3,3′-diindolylmethane, the pleiotropic effects of which were presented by L. Bjeldanes.

Processing and storage also have relevant effects on food bioactives as the different technological treatments can affect the bioactive composition and their bioavailability and metabolism. The challenges in this topic were reviewed by L. Howard and R. Prior. In fact, the production of specific Maillard reaction products was correlated with antioxidant and anti-inflammatory effects by Chen and Kitts. In addition, the structure−activity relationships of coffee compounds and their implications for optimizing the health benefits of coffee beverages were reviewed by V. Somoza.

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The future of food bioactives research will benefit from the advances in the knowledge of human genome and human microbiome. Omic technologies, including genomics, transcriptomics, metabolomics, proteomics, microbiomics, etc., open a wide range of opportunities. The state of the art in the management of chemical data and the prospects for epidemiological research were reviewed by A. Scalbert et al. In another lecture, J. B. German presented the Agricultural Chemistry's Toolset for the 21st Century.

During the meeting the perspectives on food bioactives research were discussed and indicated the need for a thorough chemical characterization of food products with description of the food metabolome that will lead to identification and quantification of many unknown natural compounds in food and changes in the human metabolome as a consequence of the food intake. There is a need to complement the food constituent's databases,[1,2] including the effects of food processing and storage on food chemical composition. In this area the study and quantification of nonextractable bioactives, and oligomeric and polymeric bioactives, and the development of new analytical methods for this purpose will be essential.[3,4]

The study of the interaction of the metabolites with macromolecules (proteins, lipids, DNA, receptors, enzymes, transporters, etc.) will provide new evidence of their effect. In the evaluation of the bioavailability and metabolism of food bioactives, the development of new analytical methods that will enable the release of the metabolites from protein, carbohydrate, and lipid molecules will help to establish the real bioavailability of bioactives and their tissue distribution. The study of deconjugation processes in specific tissues will help to understand the effects of bioactive metabolites.[5]

Many food bioactives seem to be very poorly bioavailable,[6] and they reach the colon, where they are metabolized by the gut microbiota. The microbial metabolites are often much more absorbed than the original bioactives and, therefore, could be responsible for local and systemic effects.[7,8] Differences in the microbiota of individuals could lead to different effects in vivo. It is therefore necessary to understand the effect of different types of microbiota in the metabolism of food bioactives and, conversely, how bioactives affect gut microbiota.[7] The characterization of microbial metabolites will continue to be a challenge for scientists and may require the development of advanced LC-MS and GC-MS techniques. The recent discovery of human enterotypes[9] opens a new field of research that will explain in many cases the large interindividual variability observed in human intervention studies.

The evaluation of the effect of food matrix and food processing on bioactives' bioavailability will also be a relevant area of research with opportunities for the food industry. The application of new technological and biotechnological treatments to maximize the health effects of food bioactives, including also nanoscience advances and nanotechnological applications (nanosomes, nanoparticles, nanoencapsulations, etc.), will also be a relevant topic in the *Journal* in the following years.

The interaction between different food bioactives, and between bioactives and drugs, and the evaluation of toxicological effects of food bioactives will also be a relevant topic of research.

The health effects of food bioactives have been recurrently associated with their antioxidant and free radical-scavenging effects, as free radicals and oxidation appear to be related to the onset of the main chronic diseases including cardiovascular diseases, neurodegenerative diseases, and cancer. Thus, many studies have been devoted to the evaluation of the total antioxidant capacity of foods,[10,11] the content of antioxidant bioactives, and the changes with genetic, agronomical, technological, and biotechnological factors.[12] The evaluation of antioxidant activity in vitro has been the objective of many publications during the past 15 years.[13,14] In addition, the study of the effects of food bioactives on different cell lines has also been the objective of active research and many publications.

Recent evidence has, however, indicated that the effects of antioxidants are less relevant than expected, as the antioxidant food bioactives are poorly absorbed and extensively metabolized to nonantioxidant metabolites.[15,16] In addition, many of these compounds have a very low bioavailability and never reach the tissues where they have to exert their antioxidant action in sufficient amounts.[11] This means that much of the evidence for bioactivity of food components evaluated on human cell lines may have little significance in vivo. Future studies of the mechanisms of the biological effects of food constituents on human cell lines should use the metabolites produced in vivo and at the concentrations reached in biological fluids and tissues to provide real biological significance.

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The authors declare no competing financial interest.

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