JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY

SYMPOSIUM INTRODUCTION

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Emerging Research Supporting the Positive Effects of Berries on Human Health and Disease Prevention

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ABSTRACT: The cluster of papers included here is taken from research presentations at the most recent Berry Health Benefits Symposium (BHBS). The BHBS is a biennial conference that was initiated in 2005 and met for the fourth time in 2011. Similar to the past three meetings, the 2011 BHBS covers emerging and adds to the growing body of scientific knowledge supporting the positive effects of berry fruit on human health promotion and disease prevention. Important aspects of the BHBS also include fostering open communication and collaboration among several disparate groups necessary to ensure regular and continued consumption of berry fruits among the population. These groups include berry growers, producers, and processors, as well as basic and clinical researchers, media representatives, and health professionals. Thus, the BHBS continues to be an excellent forum for presenting and disseminating new and ongoing berry health benefits research.

KEYWORDS: berries, health promotion, disease prevention

INTRODUCTION

Berries have been consumed by humans for centuries, and several are now cultivated and play important roles in modern agriculture. Because of this, many commonly consumed berries in North America including blackberries, blueberries, cranberries, strawberries, and both red and black raspberries, are readily available year-round in fresh and other derived forms. That berries have attracted significant research and public attention is not surprising. This is because these small soft-flesh fruits contain several dietary constituents known to be essential for human health such as fiber, vitamins, minerals, and folate. Apart from these macro- and micronutrients, berry fruits also contain phytochemicals (commonly referred to as "phytonutrients"), bioactive plant compounds that may provide health benefits beyond basic nutrition. Here the *Journal of Agricultural and Food Chemistry* is once again publishing a cluster of research papers that were presented at the most recent Berry Health Benefits Symposium (BHBS).

The fourth BHBS was held at the Four Seasons Hotel, Westlake Village, CA, June 27−29, 2011 (see the Website: http://www.berryhealth.org/index.html). Similar to the past three conferences, which originally met in 2005, the 2011 BHBS is organized to investigate and explore the latest scientific research related to berry health benefits.[1,2]

The host sponsors of the 2011 BHBS included the National Berry Crop Initiative, California Strawberry Commission, Driscoll's, Dole, Oregon Raspberry & Blackberry Commission, Washington Red Raspberry Commission, Wild Blueberry Association of North America, and U.S. Highbush Blueberry Council. Other sponsors included the Cranberry Institute, Brunswick Laboratories, SunBelle, Naturipe Farms, Linus Pauling Institute of Oregon State University, Ocean Spray, Oregon Strawberry Commission, California Giant Berry Farms, Nourse, Star Phytonutrients, pTeroPure (Chromadex Inc.), Plant and Food Research (Rangahau Ahumara Kai), North American Raspberry and Blackberry Association, North American Strawberry Growers Association, North Carolina Research Campus, Chilean Blueberry Committee, Sunrise Growers Frozsun Foods, BerriHealth, Milne Fruit Products, Sunnyridge, AgView Consulting, Complete Phytochemical Solutions, Anacapa Foods, Imperial Frozen Foods, Welch's, and California Walnuts.

The 2011 BHBS featured 24 oral contributions grouped in six major sessions, each with four papers. The chair of each session delivered short (15 min) introductory plenary papers to set the stage for discussions within their sessions. The six sessions and chairs were as follows: Session 1, *Berries and Cancer*, chaired by *Gary Stoner*, formerly from The Ohio State University and currently at the Department of Medicine, Medical College of Wisconsin, Milwaukee, WI; Session 2, *Berries and Metabolism*, chaired by *Ronald Prior*, formerly from the USDA-ARS at Arkansas Children's Nutrition Center and currently an Adjunct Professor of Food Science, Department of Food Science, University of Arkansas, Fayetteville, AR; Session 3, *Berries and Brain Aging*, chaired by *Barbara Shukitt-Hale*, who substituted for the late *James Joseph*, both from the USDA-ARS Jean Mayer Center for Aging at Tufts University, Boston, MA; Session 4, *Berry Compositional Chemistry and Biological Effects*, chaired by *Navindra Seeram*, from the College of Pharmacy, The University of Rhode Island, Kingston, RI; Session 5, *Berries and Cardiovascular Health*, chaired by *Britt Burton-Freeman*, from the Institute for Food Safety and Health, Illinois Institute of Technology, Bedford Park, IL; and Session 6, *Berries and Gut Health/Gut Microflora*, chaired by *Jess Reed*, from the Department of Animal Sciences, University of Wisconsin—Madison, Madison, WI. In addition, there were 16 posters in a session chaired by *Luke Howard*, from the Department of Food Science, University of Arkansas, Fayetteville, AR.

Special Issue: 2011 Berry Health Benefits Symposium

Received: August 27, 2011
Published: November 08, 2011

The cluster of papers presented in this issue of the *Journal of Agricultural and Food Chemistry* is taken from both oral and poster presentations at the BHBS 2011. However, only the oral papers are briefly outlined below.

■ ORAL PLENARY PRESENTATIONS AT THE 2011 BHBS

There were four papers in the first *Berries and Cancer* session as follows: *Harini Aiyer*, from Georgetown University Lombardi Comprehensive Cancer Center in Washington, DC, presented data from in vitro and animal studies showing the ability of berry polyphenols to prevent primary and recurrent breast cancer; *Li Shu Wang*, from the Medical College of Wisconsin Cancer Center, Milwaukee, WI, presented data from both animal and human studies showing the ability of black raspberry to prevent ulcerative colitis; *Lynn Adams*, from the City of Hope Beckman Research Institute, Duarte, CA, presented data from both cell culture and animal studies showing the ability of blueberry to modulate triple negative breast cancer; and, finally, *Gary Stoner*, who filled in for *Susan Mallery* from The Ohio State University, Columbus, OH, presented phase I/II pilot data showing the chemopreventive ability of black raspberry in oral cancer patients.

In the second session on *Berries and Metabolism*, the contributions were from *April Stull*, from the Pennington Biomedical Research Center, Baton Rouge, LA, who presented data showing the effects of blueberry on improving insulin sensitivity in obese and insulin-resistant subjects; *Michael Lefevre*, from Utah State University, Logan, UT, who presented a paper on the effects of anthocyanin-rich extracts on obesity and metabolic syndrome; *Mary Ann Lila*, from the North Carolina Research Campus at Kannapolis, NC, with a talk titled "The Berry's Enigma", which presented data on technologies to evaluate bioacessibility and bioavailability of berry polyphenols; and, finally, *Venket Rao*, from the University of Toronto, Toronto, Canada, who presented data evaluating the effects of red raspberry fruit on serum antioxidant capacity and markers of chronic diseases in human subjects.

The papers in the third session on *Berries and Brain Aging* included those by *Robert Krikorian*, from the University of Cincinnati Academic Health Center, Cincinnati, OH, who presented data showing the benefits of berry consumption in the context of cognitive aging in human subjects; *Susan McGuire*, from the University of Illinois, Champaign-Urbana, IL, who presented data showing blueberry's therapeutic effects on different mouse models of multiple sclerosis; *Jeremy Spencer*, from the University of Reading, Reading, U.K., who presented data showing the positive cardiovascular and cognitive effects of blueberry consumption in human volunteers; and, finally, *Barbara Shukitt-Hale*, from the USDA-ARS Human Nutrition Research Center on Aging at Tufts University, Boston, MA, who presented a paper on the behavioral and signaling effects of berry fruit in animal models.

The fourth session on *Berry Compositional Chemistry and Biological Effects* included contributions from *Kerry Ringer*, from Washington State University, Pullman, WA, who presented data on processing methods, such as Rapid Zone Drying, which may be used to produce nutrient-rich and value-added berry powders; *John Finley*, from Louisiana State University, Baton Rouge, LA, who presented a paper on the anti-inflammatory effects of berry pomace and fiber; *Mar Larrosa*, from the CEBAS Institute, Murcia, Spain, who presented data on the biological significance of berry ellagitannin-derived gut microbial metabolites; and *Luke Howard*, from the University of Arkansas, Fayetteville, AR, who presented data on alkalization methods to recover bioactive procyanidins from berry coproducts.

The papers in the fifth session on *Berries and Cardiovascular Health* included those by *Marva Sweeny-Nixon*, from the University of Prince Edward Island, Charlottetown, Canada, who presented both animal and human data showing the positive effects of blueberries on hypertension; *Indika Edirisinghe*, from the Illinois Institute of Technology, Bedford Park, IL, who presented data on the effects of berry compounds on endothelial function; *Arpita Basu*, from Oklahoma State University, Stillwater, OK, who presented data on the effects of blueberries, strawberries, and cranberries in obese subjects with metabolic syndrome; and *Charles Couillard*, from Laval University, Quebec, Canada, presented evidence supporting the positive effects of cranberries on cardiovascular outcomes in human subjects.

The papers in the final session on *Berries and Gut Health/Gut Microflora* were presented by *Daniel Rosenberg*, from the University of Connecticut, Storrs, CT, with data supporting the anti-inflammatory effects of black raspberries in animal models of ulcerative colitis and colon cancer; *Dhanansayan Shanmuganayagam*, from the University of Wisconsin, Madison, WI, presented data showing the effects of berry polyphenols on the gastrointestinal mucosa and microbiota in the context of enhancing the gut immune system; *Daniel Grenier*, Laval University, Quebec, Canada, presented data showing the positive effects of cranberry compounds against periodontal disease; and, finally, *M. Monica Giusti*, from The Ohio State University, Columbus, OH, presented data on the bioavailability and metabolism of various berry anthocyanins.

■ CONCLUDING REMARKS

As previously discussed (see refs 1 and 2, Introduction for the 2007 BHBS and 2009 BHBS, respectively), considerable progress continues into our scientific understanding of the various health benefits of berry fruits. It is evident that the public has a growing interest in consuming healthful foods, of which berries contribute a large and growing proportion. The BHBS continues to increase public awareness of the health benefits of berry fruits through science-based education and responsible dissemination of this information to the media.

Finally, I thank the *Journal of Agricultural and Food Chemistry*, all of the donors and participants of the 2011 BHBS symposium, and the authors who have contributed to the cluster of papers presented here.

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