



BERRY HEALTH BENEFITS SYMPOSIUM

The only conference focusing solely on berries & human health.

October 7 - October 8, 2025 | Philadelphia, PA - USA
Symposium Pre-Proceedings





Tuesday, October 7th, 2025

Discovery Room

8:00am-8:15am | Opening Remarks - Chris Christian, California Strawberry Commission

8:15am-9:00am | Keynote: Diet and the Gut Microbiome: Whose diet is it? - Dr. Johanna Lampe, Public Health Sciences Division, Fred Hutchinson Cancer Center (*Pages 8-9*)

Berries & Gut Health Session (*Pages 10-17*)

9:00am-9:15am | Current Research Review. Chair overview by Dr. Jess Reed, University of Wisconsin-Madison

9:15am-9:40am | From Gut to Immunity: Clinical and Mechanistic Evidence of Cranberry Polyphenol Actions - Dr. Susanne Talcott, Texas A&M University

9:40am-10:05am | Effects of Blueberry as a First Food for Infants on Gut Microbiota, Inflammation and Immunity: A Double-Blind, Randomized Controlled Trial - Dr. Minghua Tang, Department of Food Science and Human Nutrition at Colorado State University

10:05am-10:25am | BREAK

10:25am-10:50am | Aronia Berry: More than the Sum of its Parts for Gut Health - Dr. Bradley Bolling, University of Wisconsin-Madison, Department of Food Science

10:50am-11:20am | Berries & Gut Health Panel Discussion with Dr. Jess Reed, Dr. Susanne Talcott, Dr. Minghua Tang and Dr. Bradley Bolling

Berry Seminar Session (*Pages 18-19*)

11:20am-12:00pm | Berry Products as Dietary Ingredients to Promote Gut Health - Panel with Christian G. Krueger, Complete Phytochemical Solutions, LLC, Melanie Bush, Artemis International, and Amy Howell, Rutgers University

12:00pm-1:45pm | LUNCH BREAK

Berries, Cognition & the Cardiometabolic Gut Health Connection Session

(Pages 20-29)

- 1:45pm-2:00pm | **Current Research Review.** Chair overview by Dr. Britt Burton-Freeman, Illinois Institute of Technology
- 2:00pm-2:25pm | **Evidence on the Hypoglycemic Effects of Red Berries – *in vitro* and *in vivo* Studies** - Dr. Christine Bösch, University of Leeds
- 2:25pm-2:50pm | **Changes in Cognitive Performance, Gut Microbiome and Metabolism Following Strawberry Supplementation in At-Risk Middle-Aged Individuals** - Di Xiao, Illinois Institute of Technology
- 2:50pm-3:15pm | **Alleviation of Neurodegeneration by Wild Blueberry – From Cell to Clinic** - Dr. Chin-Kun Wang, Chung Shan Medical University
- 3:15pm-3:40pm | **Role of Gut Microbial Metabolism on the Health Benefits of Berries** - Dr. Ana Maria Rodriguez-Mateos, King's College London
- 3:40pm-4:10pm | **Berries, Cognition & the Cardiometabolic Gut Health Connection Panel Discussion** with Dr. Britt Burton Freeman, Dr. Chin-Kun Wang, Di Xiao, Dr. Christine Bösch and Dr. Ana Maria Rodriguez-Mateos
- 4:30pm-5:30pm | **Junior Investigator Poster Session Hour**





Wednesday, October 8th, 2025

Discovery Room

Berry Seminar Session *(Pages 30-31)*

9:00am-9:45am | **Dietary Intakes of Anthocyanins and Cardiometabolic Health: A Systematic Review and Meta-analysis** - Dr. Aedin Cassidy, Queen's University

Berry Special Topics Session *(Pages 32-39)*

9:45am-10:00am | **Current Research Review.** Chair overview by Dr. Mary Anna Lila, North Carolina State University

10:00am-10:30am | **Closing the Gap Between Blueberry Polyphenol Genetics and Bioaccessibility** - Dr. Massimo Iorizzo, North Carolina State University

10:30am-10:55am | **From the Gut to the Immune System: The Multifaceted Benefits of European Black Elderberry** - Melanie Bush, Artemis International

10:55am-11:15am | **BREAK**

11:15am-11:40am | **EAT (berries). MOVE. THINK. Age-Appropriate Strategies to Sharpen the Mind** - Dr. Mary Ann Lila, North Carolina State University

11:40am-12:10pm | **Berries Special Topics Panel Discussion** with Dr. Mary Ann Lila, Dr. Massimo Iorizzo and Melanie Bush

12:10pm-1:15pm | **LUNCH BREAK**

Berries, Cognition & Cardiometabolic Health Session *(Pages 40-49)*

1:15pm-1:30pm | **Current Research Review.** Chair overview by Dr. Barbara Shukitt-Hale, USDA/Tufts University

1:30pm-1:55pm | **Impact of Strawberries on Cognitive Function and Cardiovascular Health in Older Adults** - Dr. Shirin Hooshmand, San Diego State University

1:55pm-2:20pm | **Impact of Berries on Cardiometabolic, Intestinal, and Cognitive Outcomes: Insights from Preclinical and Ongoing Clinical Studies** - Dr. Rafaela Feresin, Georgia State University



2:20pm-2:45pm | **Nutrigenomics Analysis of Anthocyanins in Brain Endothelial Cells Related: From Impact on Endothelial Permeability to Molecular Mechanisms of Actions** - Dr. Dragan Milenkovic, North Carolina State University

2:45pm-3:00pm | **BREAK**

3:00pm-3:25pm | **Strawberries on Glycemic Control and Biomarkers of Inflammation and Oxidative Stress in Adults with Prediabetes: A Randomized Controlled Crossover Trial** - Dr. Arpita Basu, University of Nevada at Las Vegas

3:25pm-3:55pm | **Berries, Cognition & Cardiometabolic Health Panel Discussion** with Dr. Barbara Shukitt-Hale, Dr. Shirin Hooshmand, Dr. Rafaela Feresin, Dr. Dragan Milenkovic, and Dr. Arpita Basu

3:55pm-4:05pm | **Jim Joseph Award Presentation** | 2025 Award Presented to Dr. Barbara Shukitt-Hale

Junior Investigators Oral Presentations *(Pages 50-53)*

4:05pm-4:15pm | **A Predictive Modeling Approach for Urolithin Producer Status in Response to Strawberry and/or Red Raspberry Consumption** - Yudai Huang, Illinois Institute of Technology

4:15pm-4:25pm | **Berry (Poly)phenols with and without Fructo-Oligosaccharide on Gut Microbial Activity in Adults with Low-Grade Inflammation** - Morganne Smith, Illinois Institute of Technology

4:25pm-4:35pm | **Hepatoprotective Effects of Wild Blueberries in Mice Fed a Western Diet** - Azeezat Abdus-Salam, Georgia State University

Thursday, October 9th - Historic Berry Tour at Whitesbog Village

Optional and separate ticket.

8:00am | Group transportation departs Hilton Philadelphia at Penn's Landing

9:00am | Arrive at Whitesbog Village, begin tour

12:00pm | Picnic Lunch at Whitesbog Village

2:00pm | Group transportation returns to Hilton Philadelphia at Penn's Landing



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Johanna W. Lampe, PhD, RD
Professor
Public Health Sciences Division
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Dr. Johanna Lampe is a Professor in the Public Health Sciences Division at Fred Hutchinson Cancer Center and a Research Professor in the Department of Epidemiology at the University of Washington in Seattle. Dr. Lampe has conducted research on dietary bioactives and human health for over 30 years with a particular focus on how variation in human genetics and gut microbial metabolism affect response to diet. Dr. Lampe has received several awards for her work,

including the American Society for Nutrition Mary Swartz Rose Senior Investigator Award for research on the safety and efficacy of bioactive compounds for human health and the National Cancer Institute's Division of Cancer Prevention Stars in Nutrition and Cancer award, which recognizes research contributions in the field of nutrition and cancer. She has over 300 research publications and her research is currently funded by the US NIH and USDA/NIFA.

Keynote Address: Diet and the Gut Microbiome: Whose diet is it?

The human gut microbiome consists of trillions of microbes, including bacteria, fungi, and viruses, living in the digestive system. The microbiome plays a critical role in digestion, metabolism, and overall health of the host. Microbes metabolize a variety of constituents of diet that are indigestible by human enzymes or that escape digestion in the upper gastrointestinal tract. Microbial end-products can: 1) supply energy to host cells; 2) act as signaling molecules in host pathways; 3) be genotoxic or beneficial to host cells. Food choices and diet composition can shape gut microbial community structure (i.e. the types and amounts of microbes present) and functional activity (i.e. microbial gene expression and enzyme activity). Given that many components of host diet serve as energy for microbial growth, substrate availability is a key contributor to the composition and activity of the microbiome. Studies show that major shifts in types of dietary macronutrients (e.g., carbohydrates, proteins, fats and dietary fiber) alter the gut microbiome. Phytochemicals, such as the variety of polyphenols present in berries, have also been shown to play a role in shaping the gut microbiome and its activity. Further, microbial metabolism of phytochemicals may influence downstream host health outcomes. Understanding the impact of diet-gut microbiome interactions on disease risk may help support maintenance of optimal health and guide future disease prevention strategies.

KEYWORDS: gut microbiome, chronic disease, inflammation, diet, polyphenols

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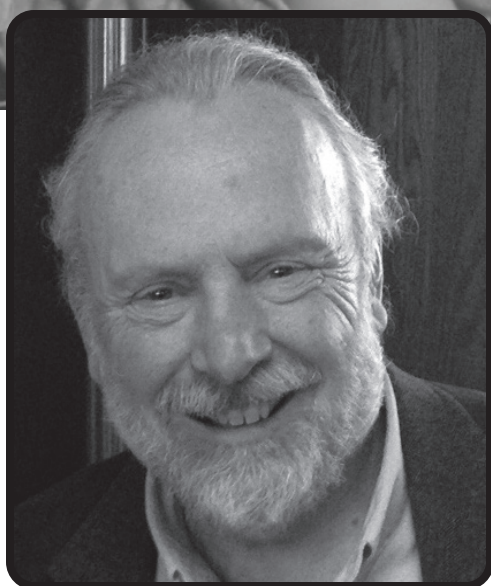
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A black and white photograph of two raspberries on a stem with leaves. The raspberries are in sharp focus, showing their characteristic bumpy texture. The background is blurred.

Tuesday, October 7th - Scientific Presentations

Berries & Gut Health



Dr. Jess Reed
University of Wisconsin-Madison
Complete Phytochemical Solutions

Session Chair
Current Research Review

Jess Reed is Emeritus Professor of Animal Nutrition at the University of Wisconsin-Madison. He received a PhD from Cornell in 1983. His 40+ years of research has focused on the effects of phytochemicals in foods and forages on human and animal health and nutrition, including 6 years at the International Livestock Center for Africa where he studied the phytochemistry of tropical forages. Starting in 1996, he began researching the effects of flavonoids in foods on human health, including cardiovascular disease, urinary tract infections and cancer. Jess has over 100 research publications in his field and a successful research program funded through competitive grants from NIH and USDA along with collaborative projects with the food industry. He is also a founding member and Chief Science Officer of Complete Phytochemical Solutions, LLC (CPS), an analytical services and consulting company for the food industry as well as a board member for Synesis LLC, a technology development company that is commercializing patents related to his research. Although Jess is semi-retired, he still maintains an active research and development program at UW-Madison and CPS. During the period from 1980 to becoming Emeritus Professor in 2021, he also maintained an active outreach and teaching program in agricultural development with project experience in over 20 countries.



Dr. Susanne Talcott
Texas A&M University

Dr. Susanne Talcott is a Professor at Texas A&M University with a research focus on translational pharmacokinetics and pharmacodynamics of botanical compounds and their physiological metabolites related to inflammation, intestinal health, and cognitive function with a focus on human clinical studies and FDA and FTC claim validation studies. It is our long-term goal to contribute valuable information to the future development of dosing recommendation for these non-nutrient food components that meets the needs of public health care, patients and consumers, and food and dietary supplement industry.

EDUCATION: B.S. in Nutrition, University of Bonn, Germany, 1998, Food Science and Nutrition, University of Florida, Gainesville, FL, 2004, Postdoctoral training, Pharmaceutics, University of Florida, Gainesville, FL, 2006

From Gut to Immunity: Clinical and Mechanistic Evidence of Cranberry Polyphenol Actions

AUTHORS: Mertens-Talcott SU

Cranberries (*Vaccinium macrocarpon*) are rich in polyphenols, including flavonoids, anthocyanins, flavonols, proanthocyanidins, and phenolic acids, which largely reach the colon unmetabolized and are transformed by the gut microbiota into bioactive metabolites. However, few human studies have jointly examined systemic and microbial responses to cranberry polyphenols in populations with metabolic risk.

In a randomized, double-blind, placebo-controlled trial, 45 overweight or obese adults consumed cranberry juice cocktail or placebo for six weeks. Cranberry consumption significantly increased serum and urinary catechol-O-sulfate and 4-hydroxyhippuric acid, demonstrating enhanced polyphenol absorption and metabolism. Although no overall change in microbial alpha diversity was observed, subgroup analyses revealed increased richness in obese participants and females. Taxonomic shifts included higher abundances of *Anaerostipes*, *Eubacterium hallii* group, and *Eggerthella*, with the latter appearing exclusively in 8 of 25 cranberry-treated participants. Sparse partial least squares analysis linked *Eggerthella* to serum 3-(3-hydroxyphenyl)propionic acid, suggesting a role in cranberry polyphenol biotransformation. In parallel, cranberry intake improved constipation scores and reduced bile-tolerant and inflammatory-related taxa, while short-chain fatty acid-producing bacteria increased [1].

Mechanistic studies further demonstrated that healthy microbiomes metabolize cranberry proanthocyanidins more effectively than ulcerative colitis microbiomes, with procyanidin B2 identified as a precursor of key phenolic acid metabolites [1,2].

By comparison, a separate 10-week clinical trial with a higher daily polyphenol dose assessed cold/flu outcomes but was limited by COVID-related exclusions. While few symptomatic cases were captured, cranberry beverages modulated immune cell counts in a sex-specific manner, including neutrophil, lymphocyte, and TNF- α responses in males.

Together, these data highlight that cranberry polyphenols, even at a low daily dose, modulate gut microbial ecology, generate bioactive metabolites, and influence intestinal health and immune function, with host factors such as metabolic status and gender shaping the magnitude of response [1-3].

This research was sponsored by Ocean Spray Cranberries, Inc., Middleborough, MA.

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Dr. Minghua Tang

**Department of Food Science and Human
Nutrition at Colorado State University**

Dr. Minghua Tang's background is in the prevention and treatment of obesity and its comorbidities, with extensive training and experience in designing and conducting clinical trials and controlled feeding studies across the lifespan. Her primary research focus is the biological underpinnings of obesity and chronic disease prevention early in life, with a special interest in the interaction of diet and gut microbiome. Dr. Tang completed my doctoral degree in human nutrition and a minor in applied statistics at Purdue University and postdoctoral training at the University of Colorado School of Medicine. Dr. Tang have designed and carried out many clinical trials using semi-controlled or controlled feeding strategies and evaluated the dietary impact on growth, gut microbiota, neurodevelopment, sleep behaviors and risk of overweight in infants and young children. Dr. Tang receives funding from the NIH, USDA and many non-profit foundations.

Effects of Blueberry as a First Food for Infants on Gut Microbiota, Inflammation and Immunity: A Double-Blind, Randomized Controlled Trial

INTRODUCTION: Complementary feeding is a critical window for shaping infant diet, gut microbiota, and immune development. This study aimed to assess the impact of daily blueberry consumption during the complementary feeding period on gut microbiota development, allergy-related symptoms, and immune biomarkers in U.S. breastfed infants.

METHODS: In a double-blind, randomized, placebo-controlled feeding trial, infants from the Denver metro area (Colorado, United States) were randomly assigned to consume up to 10 g of freeze-dried blueberry powder or an isocaloric placebo powder, combined with liquid or semi-liquid and served as a puree, daily from 5 to 12 months of age. Stool samples were collected bimonthly to assess gut microbial diversity and composition. Novel taxa were identified through parsimony insertion into the SILVA reference phylogenetic tree. Blood, and caregiver-reported allergy-related symptom data were collected at baseline and study end. Infant length, weight and dietary intakes were also assessed.

RESULTS: Seventy-six caregiver-infant pairs consented and enrolled in the study and 61 completed the study (blueberry group $n=30$, placebo group $n=31$). There were no differences between groups in energy or macronutrient intakes from complementary foods. Growth z-scores were comparable between groups. Gut microbiota alpha diversity increased over time in both groups (effect of time $p<0.001$). Several taxa exhibited nominal group-by-time interactions, including Veillonaceae, Flavonifractor, Subdoligranulum, and Butyrivibrio (all more abundant in the blueberry group), and Actinomyces, Escherichia, Streptococcus, and Romboutsia (more abundant in the placebo group).

While more infants in the blueberry group had allergy-related symptoms at baseline, they showed a greater resolution of symptoms by study end ($p=0.05$). Pro-inflammatory serum IL-13 levels were significantly reduced ($p=0.035$) and anti-inflammatory IL-10 levels increased ($p=0.052$) in the blueberry group.

CONCLUSION: Blueberry, as one of the first complementary foods, exerts potential benefits in gut microbiota development and maturation; it may also improve the resolution of allergy symptoms and modulate immune biomarkers during infancy.

KEYWORDS: blueberry, gut microbiota, immunity

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Dr. Bradley Bolling
University of Wisconsin-Madison
Department of Food Science

Dr. Bradley Bolling is a Professor in the Department of Food Science at the University of Wisconsin-Madison. He earned undergraduate and PhD degrees in Food Science at UW-Madison and received postdoctoral training at the Jean Mayer Human Nutrition Research center on Aging at Tufts University. Dr. Bolling's research focuses on health and sustainability of foods. He is leading work to advance regional innovation in sustainable agriculture. His research team is working to understand the composition and health benefits of underutilized fruits, vegetables, and dairy products as well as identifying uses for recovery of materials from processing waste streams. They have worked to further the understanding of the composition of aronia berry and its health benefits using cells, animal models of inflammatory bowel diseases, and human intervention studies. The current research of his group focusses on increasing sustainability and healthfulness of the food system, improving immune health, reducing chronic inflammation, and reducing the risk of cancer and cardiometabolic diseases. Dr. Bolling is a Scientific Editor for the Journal of Food Science and previous Chair of the International Society for Nutraceuticals and Functional Foods. His group website is: <https://bolling.foodsci.wisc.edu/>

Aronia Berry: More than the Sum of its Parts for Gut Health

AUTHORS: Bradley W. Bolling, PhD¹

AFFILIATIONS:

1. Professor, Dept. of Food Science, University of Wisconsin-Madison; 1605 Linden Drive, Madison, WI 53706. bwbolling@wisc.edu

Clinical and preclinical models suggest polyphenols can improve gut health through multiple mechanisms. Our group has been working to characterize how the polyphenol-rich aronia berry inhibits chronic inflammation in the gut. Aronia berry polyphenols are bioavailable but extensively metabolized (1). The phenolic bioaccessibility and subsequent impact on the gut microbiota upon consumption depend on the berry matrix (2). Aronia berry inhibits T-cell mediated colitis in mice through multiple mechanisms, including modulation of gut microbiota, redirecting T cell differentiation to anti-inflammatory subsets, direct cytokine inhibition, and modulation of intestinal tight junctions (3-6). Cell-based experiments using isolated aronia polyphenols suggest that these bioactives have additive or synergistic effects on the gut barrier (6). Human translational studies are needed to further our understanding of the importance of inter-individual variability in polyphenol metabolism, as well as the doses and forms required to improve gut health.

KEYWORDS: Aronia; inflammation; polyphenols; T cells; intestinal barrier

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Berry Seminar Session: Industry Panel

Berry Products as Dietary Ingredients to Promote Gut Health



Christian G. Krueger
CEO of Complete
Phytochemical
Solutions, LLC

Mr. Christian G. Krueger is the Chief Executive Officer and Co-Founder of Complete Phytochemical Solutions, LLC, a consulting and analytic service company that provides intellectual and technical expertise in phytochemistry that enables their clients to develop, manufacture and market high quality and efficacious botanical and food products for human and animal nutrition.

Mr. Krueger has a 25+ year career at the University of Wisconsin-Madison as a phytochemist specializing in the development, validation and harmonization of analytic methods. Christian has published over 70 peer-reviewed manuscripts and his expertise in natural product chemistry, understanding of supply chain management (growers, processors, formulators, and retail) and research experiences relating phytochemical structures to biologic function provides a unique skill set and background. He is a member on several Association of Official Analytic Chemists (AOAC) Expert Review Panels and works closely with the United State Pharmacopeia (USP) to develop monographs for Dietary Supplement Compendia. He is an invited Advisory Council Member for the School of Nutrition at the Southwest College of Naturopathic Medicine and Health Sciences (SCNM).



Melanie Bush
Vice President of Science
and Research for
Artemis International

Melanie Bush is the Vice President of Science and Research for Artemis International, a leading supplier of berry nutraceutical ingredients. She has been a part of the Artemis team for over 15 years and her management role spans several departments including Quality Assurance, Research & Development and Technical Sales Support. She coordinates and communicates new research on the health benefits of berries, and she is a regular contributor and writer for numerous industry publications.

Melanie attended Purdue University-Fort Wayne on a full academic scholarship, where she earned both bachelor's and master's degrees in biology. While there she received multiple academic awards for her six years of immunology research on high anthocyanin berry extracts and their immune-enhancing and anti-cancer effects.

Melanie is also currently an adjunct biology instructor at Trine University in Indiana and was previously recognized by Greater Fort Wayne Business Weekly as one of "Forty Under 40" for her service to both her work and her community. She also serves as co-chair of the Science Content Sub-Committee for the Women in Nutraceuticals (WIN) nonprofit organization.



Dr. Amy B. Howell
Scientific Advisor
The Cranberry Institute

Amy Howell, PhD is currently a scientific advisor for the Cranberry Institute, which supports research on the health benefits of cranberries and maintains a library of peer-reviewed publications on the topic. Dr. Howell was an Associate Research Scientist at the Rutgers University Marucci Center for Blueberry Cranberry Research (now retired) where she worked for 30 years on cranberry and its role in the prevention and management of bacterial diseases including urinary tract infections (UTIs), stomach ulcers, and periodontal disease. She and her team were the first to isolate and identify A-type proanthocyanidins (PACs) in cranberry that are implicated in inducing bacterial anti-adhesion in the gut and urinary tract. She is keen to have consumers utilize more natural alternative methods, such as cranberry for disease prevention in an effort to curb overuse of antibiotics and resistance development. Dr. Howell has been very involved in method development for powdered cranberry supplements, working closely with regulatory teams from AOAC and USP (US Pharmacopoeia) to determine standard methods for quantification of the bioactive compounds in cranberries. From 2000-2024, she served as the Public Member on the US Highbush Blueberry Council. She continues as a member of the USHBC Health Research Advisory Board, helping determine funding for health-related research on blueberries.



Tuesday, October 7th - Scientific Presentations

**Berries, Cognition & the Cardiometabolic
Gut Health Connection**



Dr. Britt Burton-Freeman
Illinois Institute of Technology

Session Chair

Current Research Review

Britt Burton-Freeman, Ph.D., is the Director of the Institute for Food Safety and Health's (IFSH) Center for Nutrition Research and Associate Professor in Food Science and Nutrition and Biomedical Engineering at the Illinois Institute of Technology (IIT). She also holds a research nutritionist appointment in the department of Nutrition at UC Davis and is affiliated with the Institute for Translational Medicine at the University of Chicago.

Dr. Burton-Freeman's current research interests are in mitigating disease processes through dietary approaches focused on bioactive components of foods. Specific disease targets are cardiovascular, metabolic syndrome and obesity. Current work focuses on physiological effects and mechanistic underpinnings of polyphenols and novel carbohydrates, including their pharmaco-kinetic and -dynamic relationships in human biology to impact health status. The influence of food matrix, processing, host/microbiome characteristics and interactions are also being addressed.

As the Director for the Center for Nutrition Research at IIT/IFSH in conjunction with the National Center for Food Safety and Technology, she leads a nutrition and health initiative with food industry partners and government collaborators to provide critical science that supports policy, dietary recommendations and comprehensive innovative solutions linking nutrition and food safety to improve the health and quality of life of Americans. Recent work has focused on fiber definitions for labeling and perceptions/responses to key terms associated with health in low income populations.

Dr. Burton-Freeman is actively involved in multiple professional societies dedicated to health and disease abatement including the American Society for Nutrition, the Obesity Society, the American Chemical Society and the Institute of Food Technologist. Dr. Freeman publishes in various top Journals and is co Editor-in-Chief of Nutrition and Healthy Aging.

Dr. Burton-Freeman holds a BS in Dietetics from the California State University, Chico, a MS and PhD in Nutritional Biology from the University of California, Davis and completed a postdoctoral fellowship in the Department of Internal Medicine at University of California, Davis. Dr. Burton-Freeman has held professional appointments in academia and the biotechnology industry leading research programs and teams to deliver on basic and clinical science objectives.



Dr. Christine Bösch
University of Leeds, UK

Dr. Christine Bösch is Associate Professor in Nutrition and Director of Research and Innovation in the School of Food Science and Nutrition, University of Leeds, UK. With a background in nutritional sciences, a major interest is on diet and health, and the development of dietary strategies to prevent and alleviate chronic disease. Her main research focus is on food bioactive compounds such as phytochemicals, their mechanisms of action, and efficacy of dietary bioactive supplementation to benefit metabolic health. Current research includes phytochemical recovery from fruit and vegetable side streams, e.g. berries, grapes as sustainable sources for bioactive ingredients and the development of downstream applications for food, pharmaceutical, feed and other purposes.



Evidence on the Hypoglycemic Effects of Red Berries – *in vitro* and *in vivo* Studies

AUTHORS: Christine Bösch¹

AFFILIATIONS:

1. Associate Professor, University of Leeds, School of Food Science and Nutrition, Leeds, United Kingdom

The consumption of red berries, rich sources of anthocyanins, has been associated with beneficial effects towards prevention and/or alleviation of chronic disease such as obesity, diabetes and cardiovascular disease. In particular, the hypoglycemic properties of anthocyanins have been highlighted in the literature, although the *in vivo* evidence for hypoglycemic properties of anthocyanin-rich red berries is not uniform. With knowledge evolving on the mechanisms underlying anthocyanin health benefits, the need to understand differential effects of different types of anthocyanins becomes increasingly evident.

We have compared the potential of a range of different anthocyanin-containing berries to inhibit carbohydrate-hydrolysing enzymes alpha-amylase and alpha-glucosidase. The findings highlight that berries differ in their capacity to inhibit these enzymes with blackcurrant, blackberry and raspberry being generally more efficient, e.g. compared to blueberry. For example, the IC₅₀ value of blackcurrant was approximately four times lower than that of blueberry for both, alpha-amylase as well as alpha-glucosidase enzymes. In line with *in vitro* results, a recent *in vivo* human postprandial study has demonstrated a marked reduction of glucose iAUC (approx. 30%) following consumption of blackcurrant drink, compared to a 13% reduction in response to a blueberry drink, and compared to the carbohydrate matched control. These results highlight the differing properties of red berries to lower postprandial glucose response, potentially linked to their unique anthocyanin profiles. However, it cannot be excluded that other bioactives and compounds that are present in the samples may markedly contribute to hypoglycemic properties of red berries.

KEYWORDS: anthocyanins, red berries, postprandial glycemia, blueberry, diabetes, hypoglycemic response



Di Xiao

Illinois Institute of Technology

Di Xiao is a PhD candidate in the Department of Food Science and Nutrition at the Illinois Institute of Technology, where her research centers on the role of polyphenol-rich berry fruits in improving metabolic and cognitive health in at-risk populations. With over a decade of experience in clinical trial operations and regulatory compliance, she brings a unique translational perspective that bridges rigorous science and real-world dietary strategies.

Her work investigates how berry-derived compounds interact with the gut microbiome to influence insulin sensitivity, inflammatory processes, and neurocognitive outcomes. Di's recent studies explore both acute and chronic effects of red raspberry and strawberry consumption on glucose metabolism, polyphenol bioavailability, and memory performance in at-risk populations.

In addition to her doctoral research, Di holds a senior role at Johnson & Johnson MedTech, where she oversees global clinical studies in neurovascular health. She brings a unique translational perspective bridging clinical research and nutrition science.

Changes in Cognitive Performance, Gut Microbiome and Metabolism Following Strawberry Supplementation in At-Risk Middle-Aged Individuals

AUTHOR: Di Xiao¹

AFFILIATION:

1. PhD Candidate, Department of Food Science and Nutrition and Center for Nutrition Research, Institute for Food Safety and Health, Illinois Institute of Technology, Chicago, IL, USA

Cognitive decline and dementia are major public health concerns that develop over decades, often in parallel with metabolic disturbance and systemic inflammation during midlife. Overweight and obesity are associated with vascular and inflammatory risk factors that adversely affect brain health. The gut microbiome has emerged as a potential mediator of these effects, with evidence that berry-derived polyphenols interact with gut microbes to yield bioactive metabolites relevant to metabolic and cognitive function. Strawberries, rich in anthocyanins and ellagitannins, have been shown to benefit vascular, metabolic, and cognitive outcomes; however, few controlled trials have concurrently examined cognition, blood biomarkers, and gut microbiome endpoints.

In this randomized, double-blind, placebo-controlled, parallel trial, middle-aged adults (n=19; 45–65 y) who are overweight and obesity with subjective memory complaints consumed daily freeze-dried strawberry powder (26 g, equivalent to ~1.5 cups fresh fruit) or placebo for 12 weeks. Fecal and fasting blood samples, along with neuropsychological assessments, were collected at baseline and post-intervention. Cognitive measures targeted executive function, working memory, processing speed, and verbal memory, while metabolic markers included fasting glucose, insulin, and lipid profiles. Gut microbiome composition and functional pathways are being characterized using metagenomic sequencing.

Preliminary analyses indicate feasibility of the intervention and successful collection of cognitive, metabolic, and microbiome data. Full analyses of cognitive outcomes, metabolic markers, and gut microbiome profiles are ongoing and will be presented at the Berry Health Benefits Symposium.

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Dr. Chin-Kun Wang
Chung Shan Medical University, Taiwan

Dr. Chin-Kun Wang is a distinguished professor in Chung Shan Medical University (CSMU), UN Goodwill Ambassador, President of International Society for Precision Health. Former President of International Society for Nutraceuticals and Functional Foods (ISNFF), Fellows of IAFoS, ISNFF and IFT, Honorary President of Nutrition Society of Taiwan. He got his MD, Ph.D. degree from National Taiwan University and worked at Chung Shan Medical University in 1993. In 1996, he was promoted as a full professor, and then took the positions of the Chair, Dean, Vice President and President at CSMU. His research work is focused on human clinical trials and human metabolism of medicine, nutritional supplement, nutraceuticals, herbs, and functional foods. Recently Dr. Wang also paid great attention on precision nutrition by using big data. He got the National Award of Biomedicine for his great contribution to the medical education in 2008. Dr. Wang also was awarded outstanding research by many societies from 2009 to 2024. For food safety and nutrition, he promoted the legislation for school sanitary law and national nutrition law. Dr. Wang is now working on the nutrient fortification for all life spans and set up the two way AI platform. In 2024, Dr. Wang served as an UN Goodwill Ambassador. He tries his best to treat zero hunger and work together with the scientists around the world and would like to promote the advanced development of health.

Alleviation of Neurodegeneration by Wild Blueberry - From Cell to Clinic

AUTHORS: Chin-Kun Wang¹

AFFILIATIONS:

1. Professor, Chung Shan Medical University, Taiwan

Dementia is a neurodegeneration disease characterized by memory loss, cognitive decline, and behavior changes. Alzheimer's disease (AD) is the most common form of dementia, accounting for approximately 70% of all cases. Amyloid beta (A β) is closely associated with the early stage of AD, and its accumulation in the brain leads to mitochondrial dysfunction, synaptic function loss and neuronal apoptosis. Wild blueberry is rich in polyphenols and some other phytochemicals. This study aims to investigate the effects of wild blueberry 80% ethanol crude extract on the neuronal and synaptic function by using HT-22 neuronal cells and use the dry wild blueberry powder for clinical trial. The indicators include neuroprotection (4', 6-diamidino-2-phenylindole; DAPI, caspase 3, and cleaved caspase-3), mitochondria function (dihydroethidium; DHE, and JC-1 staining, peroxisome proliferator-activated receptor-gamma coactivator-1 alpha (PGC-1), sirtuin 1 (Sirt1), and nuclear factor erythroid 2-related factor 2 (Nrf2), and synaptic function (neurexin-2 & -3, neuroligin-2, postsynaptic density protein-95 (PSD-95), brain-derived neurotrophic factor (BDNF), and insulin-like growth factor (IGF-1)). All results showed that wild blueberry extract significantly protected HT-22 cells from A β -induced toxicity and improved mitochondrial function, also enhanced synaptic function. In the clinical trial, 45 AD patients including clinical dementia ratio 1 (CDR 1, n=15), CDR 2 (n=15), and CDR 3 (n=15) were averagely randomized into black raspberry berry (BRBs) group, BRBs + wild blueberry (BBs), and control group in a six-month intervention. Every subject took two bags of berry powder (25 grams per bag) daily (two bags of BRBs, or one bag of BRBs and one bag of BBs) during the intervention. Results clearly showed that the intervention of BRBs and BRBs+BBs greatly increased the antioxidant status and decrease the body fat, BMI and inflammatory markers (TNF- α , IL-1, IL-8, COX-2 and iNOS) of all patients. The alleviation on dementia was found by the intervention of two groups, BRB+BBs showed significantly better effect by BRBs alone.

KEYWORDS: wild blueberry, HT-22 cells, synaptic function, CDR, inflammation



Dr. Ana Maria Rodriguez-Mateos
King's College London

Dr. Rodriguez-Mateos is a Professor of Human Nutrition at the Department of Nutritional Sciences of King's College London. Her research aims to investigate the health benefits of plant foods and phytochemicals, with a strong focus on understanding the bioavailability, metabolism and cardiovascular health benefits of dietary (poly)phenols. More recent interests include the investigation of the role of the gut microbiome on the health benefits of phytochemicals, and the development of biomarkers of food intake using metabolomic approaches. Her expertise includes development and validation of analytical methods for the analysis of foods and biological samples using LC/GC-MS and performance of randomized controlled trials with cardiovascular outcomes.

She is a Registered Nutritionist, Fellow of the Royal Society of Chemistry and Fellow of the UK Higher Education Academy. She received the Nutrition Society Silver Medal Award in 2023 for scientific excellence in the field of Nutrition. She is the co-chair and founder of the Nutrition Society Special Interest Group on Phytochemicals and Health.

Role of Gut Microbial Metabolism on the Health Benefits of Berries

AUTHORS: Ana Rodriguez-Mateos¹

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Epidemiological and intervention studies suggest that diets rich in (poly)phenols, such as those found in berries, may provide cardioprotective effects, yet underlying mechanisms remain unclear and findings from randomized controlled trials indicate a high variability in response among individuals [1,2]. The gut microbiota plays a central role by transforming (poly)phenols into bioactive low-molecular-weight metabolites through reactions such as hydrolysis, oxidation, and demethylation [3]. Inter-individual differences in microbial composition generate distinct (poly)phenol metabolising capacities or “metabotypes,” exemplified by equol producers and non-producers from isoflavones [5], or urolithin metabotypes A, B and O from ellagitannins [6], which shape metabolite profiles and may influence health outcomes. Evidence directly linking metabotypes to differential health effects is still very limited, and the link between gut microbial production and gut microbiota diversity and composition remains poorly explored [2]. Our recent studies demonstrate that the gut microbiota’s (poly)phenol-metabolizing capacity is strongly associated with its diversity and composition. In a cohort of healthy individuals (n=299), we observed striking variability in urolithin production from raspberry ellagitannins, not only qualitatively (number of metabolites produced) but also quantitatively (amount produced), with distinct microbial signatures underlying these differences. Stratifying participants by metabotype in randomized controlled trials further revealed differential responses to the intervention. Together, these findings support a critical role of gut microbial metabolism in mediating the cardiometabolic effects of berry (poly)phenols.

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Dr. Aedín Cassidy
Queen's University Belfast

Aedín Cassidy is Chair in Nutrition & Preventive Medicine and Director for Interdisciplinary Research at the Institute for Global Food Security, Queen's University, Belfast. She is also one of the Co-Directors of the Co-Centre for Sustainable Food Systems. Her research has focused on determining the relative importance of different flavonoids for health, leading clinical trials, combined with large population-based prospective data, bioavailability and mechanistic studies.

Berry Seminar Session: Dietary Intakes of Anthocyanins and Cardiometabolic Health: A Systematic Review and Meta-analysis

SPEAKER: Aedín Cassidy

CO-AUTHORS: E Avendano, H Ellingson, E Digga, A Velasco Nieves, L Chen, M Wu, S Hanumantha Setty, S Morley, P Curtis, N Nirmala

AFFILIATIONS: Tufts Medical Center, Boston; Norwich Medical School, University of East Anglia; Co-Centre for Sustainable Food Systems, Queen's University Belfast

Meta-analyses support anthocyanins cardiometabolic benefits in heterogenous populations (including diseased), but efficacy in 'healthy' individuals remains unknown. Across prospective cohorts, and randomized controlled trials (RCTs; $\geq 50\text{mg/d}$ anthocyanins from food/extract/supplements), we assessed impacts on surrogate cardiometabolic biomarkers and clinical endpoints.

Database searches identified eligible cohorts and RCTs (1946-Sept 2024), which reported anthocyanin intake (or data, from which anthocyanin intake could be calculated), and cardiovascular disease (CVD) risk or cardiometabolic biomarkers. Random-effects meta-analysis, and GRADE assessment followed.

Across 18 cohorts, highest vs. lowest habitual anthocyanin intake showed risk reductions (RR) of 26% CVD incidence (4 studies), 18% MI (5 studies), 11% T2DM (type 2 diabetes, 8 studies), 9% CVD mortality (10 studies), and 8% hypertension risk (6 studies). GRADE identified moderate evidence for CVD/MI. Stroke risk was unaffected.

Across 63 RCTs, chronic anthocyanins (≥ 1 day) improved flow-mediated dilation (FMD) (net change: 1.41%), and $>210\text{mg/d}$ pulse wave velocity (PWV; -0.27 m/s). Acute anthocyanins (≤ 1 days) improved FMD (1.53%), PWV (-0.24 m/s) and insulin concentrations (-2.24 pmol/L). GRADE identified strong evidence for acute FMD, moderate for chronic FMD, and acute PWV. Lipids, blood pressure, glucose, HbA1c, and Homeostatic Model Assessment for Insulin Resistance were unaffected. In sub-analysis, by anthocyanin type, cyanidin improved acute FMD (1.62%), while delphinidin improved PWV (-0.33), insulin (-2.32 pmol/L) and triglycerides (-0.10 mmol/L).

Higher anthocyanin intake lowers CVD, MI, hypertension and T2DM risk in cohorts, while RCTs show that dietarily achievable anthocyanin intakes (as low as 50mg/d) improve atherosclerosis and metabolic syndrome biomarkers in healthy individuals. These findings provide comprehensive evidence which supports the inclusion of anthocyanins within evidence-based nutrition guidelines for CVD prevention.

This review was registered in the PROSPERO database as CRD420251015416.

KEYWORDS: anthocyanins, cardiovascular disease, diabetes, flow mediated dilatation, pulse wave velocity, blood pressure, healthy individuals

Avendano et al (Paper UNDER REVIEW)

A black and white photograph of several raspberries. Some are in a small wooden bowl on the right, while others are scattered on a wooden surface in the background. The lighting is soft, highlighting the texture of the berries.

Wednesday, October 8th - Scientific Presentations

Berries Special Topics



Mary Ann Lila, PhD
North Carolina State University

Session Chair
Current Research Review

Dr. Mary Ann Lila is a David H. Murdock Distinguished Professor and Director, Plants for Human Health Institute at North Carolina State University.

Over the past two decades, Dr. Lila's research has centered on bioactive phytochemical constituents, particularly polyphenolic/flavonoid phytoactives, their capacity to mitigate immunosuppression and inflammation, and the differential efficacies that these compounds exert in individual human subjects. The primary emphases in her team are (1) rigorous structural characterization of phytochemicals and metabolites (2) elucidation of phytochemical interactions that potentiate benefits for human health maintenance and allergy attenuation, (3) development of functional ingredients that stabilize the bioactive properties of these otherwise ephemeral constituents, (4) individualized responses of subjects to phytoactive agents (tentatively as a consequence of their differential intestinal microbiota profiles, which condition the production of active catabolites), and (5) interpretation of the bioavailability/bioaccessibility of plant-derived metabolites.



Dr. Massimo Iorizzo
North Carolina State University

Dr. Iorizzo is a Professor and distinguished Faculty Scholar at NC State University. His research program focuses on comparative structural genomics and genetics for traits associated with enhanced quality characteristics including health properties. Crops of interest of his program include carrot, blueberry, cranberry, spinach, pineapple, and banana. Since 2010, his research has significantly contributed to establish the largest set of omics tools for these crops and elucidated the genetic mechanism controlling nutrient and bioactive accumulation (e.g. carotenoids, anthocyanins). Through interdisciplinary collaborative research, he initiated efforts to understand the relationship between genetics and nutrigenomic properties of plant bioactive like anthocyanin. This work is opening a new field of research that can contribute to close the gap between crop breeding and genetics and their nutritional value. He is the director and co-project director of large multidisciplinary and international projects in blueberry, cranberry and carrot that are contributing to advance application of molecular breeding in these crops. Dr. Iorizzo is a very active scientific writer, he has authored and co-authored 126 referred publications, and >280 non-referred publications and oral presentations.

Prior to joining NCSU, Dr. Iorizzo was a Research Scientist at University of Wisconsin-Madison. Before this, he was PhD student at the University of Naples Federico II and visiting scientist at the University of Minnesota.

Closing the Gap Between Blueberry Polyphenol Genetics and Bioaccessibility

AUTHORS: Massimo Iorizzo¹, Molla Fentie Mengist², Mary Ann Lila¹, Colin D Kay³ and Mario Ferruzzi⁴

AFFILIATIONS:

1. Professor, North Carolina State University
2. Assistant Professor, Virginia State University
3. Professor, University of Arkansas for Medical Sciences
4. Professor, Virginia Polytechnic Institute and State University

Today, a growing body of evidence supports the roles of phytochemicals from fruits and vegetables (F&V) in meeting nutritional requirements and preventing chronic diseases⁽¹⁾. Despite this knowledge, breeding for F&V's nutritional value largely relies on selection for the content of certain phytochemicals, and factors contributing to their nutrigenomic properties (bioaccessibility, bioavailability, and bioactivity) have not been addressed. For example, the chemical structure of phytochemicals that is under strong genetic control, can modulate their ability to be released from the plant matrix and be absorbed, or their biological activity. This talk will summarize work done by Dr. Iorizzo and collaborators on the genetics of polyphenols in blueberry and to understand the link between anthocyanin genetics and bioaccessibility. Overall, chlorogenic acid content and the decoration of the anthocyanins with the different sugars and acyl groups explain most of the variation in polyphenols observed in cultivated blueberry⁽²⁾. Four regions of the blueberry genome control anthocyanin acylation and glycosylation, and one region controls chlorogenic acid content (>100-fold)⁽³⁾. Two acyltransferases were identified as the genes responsible for the addition of acyl groups⁽⁴⁾. Parallel work done using an in-vitro model indicated that acylated anthocyanin increased anthocyanin bioaccessibility up to 3-fold⁽⁵⁾. Together these studies indicated that developing new blueberry cultivars with higher acylated anthocyanin through a genetic approach could lead to increased bioaccessibility, which could result in increased bioavailability. Future work will need to be done to test this hypothesis in animal models or clinical trials. Overall, the work indicates that there is an opportunity to expand transdisciplinary research that can enable the development of a DNA-based breeding strategy to develop new F&V varieties with improved health benefits and added value.

KEYWORDS: blueberry, polyphenol genetics, bioaccessibility

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Melanie Bush
Artemis International

Melanie Bush is the Vice President of Science and Research for Artemis International, a leading supplier of berry nutraceutical ingredients. She has been a part of the Artemis team for over 15 years and her management role spans several departments including Quality Assurance, Research & Development and Technical Sales Support. She coordinates and communicates new research on the health benefits of berries, and she is a regular contributor and writer for numerous industry publications.

Melanie attended Purdue University-Fort Wayne on a full academic scholarship, where she earned both bachelor's and master's degrees in biology. While there she received multiple academic awards for her six years of immunology research on high anthocyanin berry extracts and their immune-enhancing and anti-cancer effects.

Melanie is also currently an adjunct biology instructor at Trine University in Indiana and was previously recognized by Greater Fort Wayne Business Weekly as one of "Forty Under 40" for her service to both her work and her community. She also serves as co-chair of the Science Content Sub-Committee for the Women in Nutraceuticals (WIN) nonprofit organization.

From the Gut to the Immune System: The Multifaceted Benefits of European Black Elderberry

European Black Elderberries (*Sambucus nigra* L.) have long been valued in traditional medicine, and modern research increasingly supports their broad-spectrum health benefits, particularly in the interrelated domains of immune modulation, gut microbiota support, and antiviral defense. This presentation brings together clinical and mechanistic evidence from multiple studies exploring the physiological impacts of elderberry-derived compounds, especially from polyphenol-rich extracts.

First, data from the ELDERGUT trial, a 9-week intervention, demonstrate that supplementation with a standardized elderberry extract induces individualized yet consistent shifts in gut microbiota composition. Notably, a sustained increase in *Akkermansia* spp., a genus linked to mucosal health and metabolic regulation, was observed in a subset of participants beyond the supplementation period. These findings suggest a potential prebiotic-like effect of elderberry polyphenols on the intestinal microbiome.

Second, a randomized, placebo-controlled clinical trial involving 312 long-haul travelers provides evidence that elderberry extract reduces the duration and severity of upper respiratory symptoms associated with air travel. While incidence rates were comparable, symptom burden and illness duration were significantly lower in the elderberry group, supporting its use as a supportive agent during physiologically stressful conditions. To complement these findings, other studies report the direct antiviral properties of elderberry anthocyanins against respiratory pathogens, as well as in vitro evidence of elderberry-induced dendritic cell maturation, indicating enhanced innate immune surveillance and directly promoting T cell activation, a key step in adaptive immune priming. There are also ongoing trials that highlight new insights into molecular mechanisms and potential clinical applications of European black elderberry.

Together, these findings demonstrate that European black elderberries exert multi-targeted effects on host health through microbiome modulation, immune activation, and direct antiviral activity. This offers implications for future research, as well as nutraceutical and functional food development.

KEYWORDS: black elderberry, polyphenols, anthocyanins, prebiotic, microbiota, cold symptoms, complementary medicines, supplements, European black elderberry fruit extract, Influenza A virus, SARS-CoV-2, antiviral, quinine, T cell stimulation, dendritic cells, polysaccharides

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Mary Ann Lila, PhD
North Carolina State University

Dr. Mary Ann Lila is a David H. Murdock Distinguished Professor and Director, Plants for Human Health Institute at North Carolina State University.

Over the past two decades, Dr. Lila's research has centered on bioactive phytochemical constituents, particularly polyphenolic/flavonoid phytoactives, their capacity to mitigate immunosuppression and inflammation, and the differential efficacies that these compounds exert in individual human subjects. The primary emphases in her team are (1) rigorous structural characterization of phytochemicals and metabolites (2) elucidation of phytochemical interactions that potentiate benefits for human health maintenance and allergy attenuation, (3) development of functional ingredients that stabilize the bioactive properties of these otherwise ephemeral constituents, (4) individualized responses of subjects to phytoactive agents (tentatively as a consequence of their differential intestinal microbiota profiles, which condition the production of active catabolites), and (5) interpretation of the bioavailability/bioaccessibility of plant-derived metabolites.

EAT (berries). MOVE. THINK. Age-Appropriate Strategies to Sharpen the Mind

AUTHORS: Mary Ann Lila¹, David Nieman² and Carol Cheatham³

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2. Human Performance Lab, Appalachian State University
3. Nutrition Research Institute, University of North Carolina Chapel Hill

As life expectancy of the world's population increases, dementia (defined as the age-related decline from previously attained cognitive levels) is a looming threat to an individual's health span, and it causes a heavy economic burden to families and to society. Recent work from our labs and others has demonstrated that flavonoid-rich berry interventions can attenuate biomarkers of inflammation including neuroinflammation, effectively mitigate cognitive dysfunction and decline, and sharpen cognition. Dietary flavonoids act as prebiotics; they can alter both the profiles and the diversity of the gut microbiome. Dietary flavonoids are largely catabolized by the gut microbiota in the lower gastrointestinal tract, and only then enter circulation as anti-inflammatory and immunomodulatory phenolic metabolites. We previously demonstrated with high-fat diet-fed antibiotic-treated mice that dietary blackcurrants exerted metabolic protection, but only under the influence of healthy gut microflora. Further mechanistic work established that the gut-derived flavonoid metabolites were responsible for the observed bioactivity, and not parent/precursor compounds. In clinical work, our team found that a 6-month intervention with wild blueberries restored speed of processing (a measure of cognitive ability) in older adults with mild cognitive decline to the level of a reference group (with no cognitive deficits). In other clinical work (unrelated to cognition), we showed that intensive, prolonged running led to a post-exercise surge in plasma phenolic metabolites and subsequently showed that even moderate physical exertion (walking) significantly accelerated the uptake and increased the concentration of gut-derived phenolic metabolites into circulation, even in the absence of additional flavonoid supplementation. While it is evident that the gut microbiome exerts a profound influence on cognitive function, that both moderate physical exertion and flavonoid intake boost cognitive benefits, and that both aerobic movement and flavonoid intake influence the microbiome, little information exists on the combined impacts of flavonoid intake and physical exertion on cognitive function, as modulated by the gut microbiome. NC State University, UNC Chapel Hill and Appalachian State University have partnered in a recently launched NIH NIA project which hypothesizes that the positive cognitive benefits from dietary berry flavonoids, and from moderate physical exertion can both be linked to enhanced circulation of gut-derived flavonoid metabolites, mediated by the activities of colonic microbiota.

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Wednesday, October 8th - Scientific Presentations



Berries, Cognition & Cardiometabolic Health



Dr. Barbara Shukitt-Hale
USDA & Tufts University

Session Chair

Current Research Review

Dr. Barbara Shukitt-Hale is a USDA-ARS Research Psychologist in the Diet and Aging Brain, Sensory Systems Directive at the Human Nutrition Research Center on Aging (HNRCA) at Tufts University in Boston, MA. Additionally, she serves as an Affiliate Faculty member in the Psychology Department and an Adjunct Associate Professor in the Friedman School of Nutrition Science and Policy at Tufts University. She received her Ph.D. in Experimental Psychology from Boston University in 1993. She has published more than 260 manuscripts and selected papers and serves on the Editorial Board of numerous scientific journals.

Dr. Shukitt-Hale's current work involves investigating motor and cognitive performance changes due to oxidative stress and inflammation and the possible amelioration of these effects with proper nutrition. She has developed and utilized behavioral techniques to examine the motor and cognitive performance changes due to oxidative stress and inflammation during aging and under other oxidative stress/inflammatory conditions (such as radiation), in conjunction with changes in cellular function and signal transduction. She then uses these models to examine the effects of different polyphenolic-rich diets on these age-related behavioral parameters as well as changes in brain function. Notably, she has shown that phenolic compounds have beneficial effects on the brain, including enhanced signaling, autophagy, and neurogenesis and that fruit and vegetable extracts, such as from strawberries, blueberries, and walnuts, can prevent and even reverse age-related changes in brain performance. These findings have had tremendous impact in the popular press. Recently, Dr. Shukitt-Hale has focused on translating these results to humans through the use of clinical trials. She continues to research the mechanisms behind the positive effects of foods.



Dr. Shirin Hooshmand
San Diego State University

Shirin Hooshmand, PhD, RD, received her doctoral degree from the Department of Nutrition, Food and Exercise Sciences at Florida State University followed by her post-doctoral training at the same institution. Shirin joined San Diego State University in 2011 as a faculty and currently holding the position of Professor of Nutrition at San Diego State University, she is also a Registered Dietitian.

Her primary research interests include understanding physiological responses to diet and dietary components during normal, and pathophysiological states during various stages of the life cycle using clinical interventions and preclinical models including cell culture and animal models.

She has published 70 original articles in peer reviewed journals and presented more than 120 abstracts at national and international symposia. In addition to publishing in scientific journals, she also actively disseminates research findings in formats ranging from scientific presentations and webinars to podcasts, and popular press articles.

Shirin is recognized for her academic achievements and she has been honored with the Graduate Women in Science fellowship, Florida State University Alumni award, San Diego State University Outstanding Faculty Award, Graduate Professor of the Year Award and Senate Distinguished Teaching Award.



Impact of Strawberries on Cognitive Function and Cardiovascular Health in Older Adults

AUTHORS: Shirin Hooshmand, PhD, RD¹

AFFILIATIONS:

1. Professor, San Diego State University

Strawberry consumption may aid in improving cognitive function and cardiovascular health given their nutrient composition and antioxidant capacities. We hypothesized that 2 cups of fresh strawberries per day provided as a freeze-dried strawberry powder (26 g/d) may improve cognitive performance and cardiovascular health relative to a control. Using a randomized, crossover, double-blind, placebo-controlled clinical trial, 35 healthy older adults (17 women, 18 men, age 72 ± 6 years, BMI 26.4 ± 3.9 kg/m²) consumed 26 g of freeze-dried strawberry powder (strawberry) and a control powder (control) daily for 8 weeks each with a 4-week washout period. Strawberry supplementation was expected to improve cardiometabolic health parameters, and cognitive performance measured with the National Institutes of Health Toolbox. Processing speed ($p < 0.001$) improved during the strawberry phase and episodic memory ($p = 0.002$) improved during the control phase. For cardiovascular measures, strawberry consumption reduced systolic blood pressure ($p = 0.044$) and a significant main effect of time for reduced waist circumference ($p = 0.043$) was detected. Serum triglycerides increased in the control group ($p = 0.012$) but not after consuming strawberries. Total antioxidant capacity significantly decreased during the control phase ($p = 0.032$) and significantly increased with strawberry consumption ($p = 0.047$). This study demonstrated that 26 g of freeze dried strawberries improve cognitive processing speed, lower systolic blood pressure, and increase antioxidant capacity, potentially promoting cognitive function and improving cardiovascular risk factors in cognitively healthy individuals.

KEYWORDS: Berry, Fruit, Cardiometabolic health, Memory, Aging

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1. Strawberries modestly improve cognition and cardiovascular health in older adults, Delaney, Kristin et al. Nutrition, Metabolism and Cardiovascular Diseases, Volume 35, Issue 8, 104018



Dr. Rafaela Feresin
Georgia State University

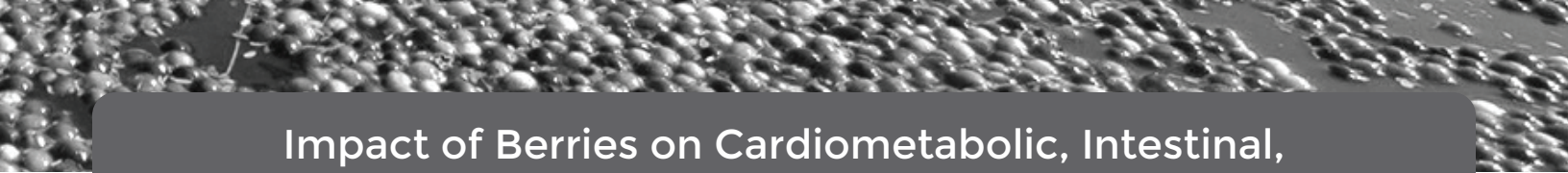
Dr. Feresin is an Associate Professor of Nutrition at Georgia State University (GSU) with a joint appointment in Biology and Chemistry. She is a Core Member of the GSU Center for Neuroinflammation and Cardiometabolic Diseases and serves as the Director of the Ph.D. program in Chemistry with a concentration in Nutritional Sciences.

Dr. Feresin earned her undergraduate degree in Nutrition and completed her Dietetic Internship at the Federal University of Goiás in Brazil, her home country. She went on to obtain an M.S. and Ph.D. in Nutritional Sciences from Florida State University (FSU), where she also completed postdoctoral training in Vascular Biology.

Dr. Feresin's research program integrates molecular and clinical studies to identify nutritional strategies for preventing and managing cardiometabolic disorders. Her work focuses on elucidating the mechanisms through which functional foods and their bioactive compounds influence disease outcomes, with an emphasis on their safety and efficacy in clinical applications. She and her collaborators have conducted extensive research on the cardiovascular benefits of plant-based foods, particularly berries. Her studies have demonstrated that berry consumption can improve cardiovascular function, and modulate inflammation, oxidative stress, and intestinal microbiota, key factors in cardiometabolic disorders.

Dr. Feresin's research has been supported by the USDA's National Institute of Food and Agriculture and is currently funded by The Peanut Institute, USDA-Agricultural Research Services, and the Wild Blueberry Association of North America. She has authored over 40 peer-reviewed publications and contributed to three book chapters.

Dr. Feresin is actively engaged in professional societies, including the American Society for Nutrition (ASN), where she served as Chair of the Dietary Bioactive Components Research Interest Section. Additionally, she is a member of the Editorial Board for Nutrition Research. Her contributions have been recognized with several awards, including the 2025 Mid-Career Award for Contributions to Health Sciences from GSU's Lewis College and the 2024 Mary Swartz Young Investigator Award from the American Society for Nutrition Foundation.



Impact of Berries on Cardiometabolic, Intestinal, and Cognitive Outcomes: Insights from Preclinical and Ongoing Clinical Studies

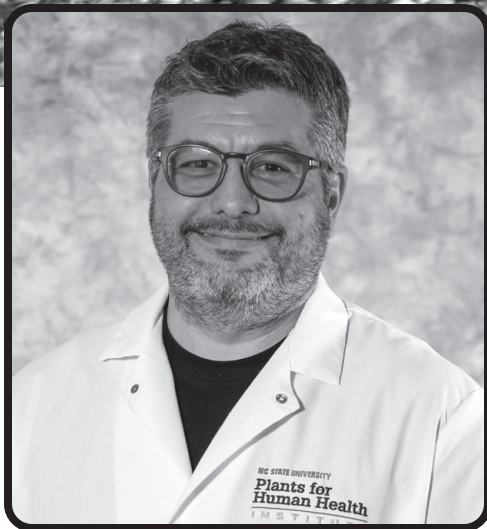
AUTHORS: Rafaela Feresin¹

AFFILIATIONS:

1. Associate Professor, Georgia State University

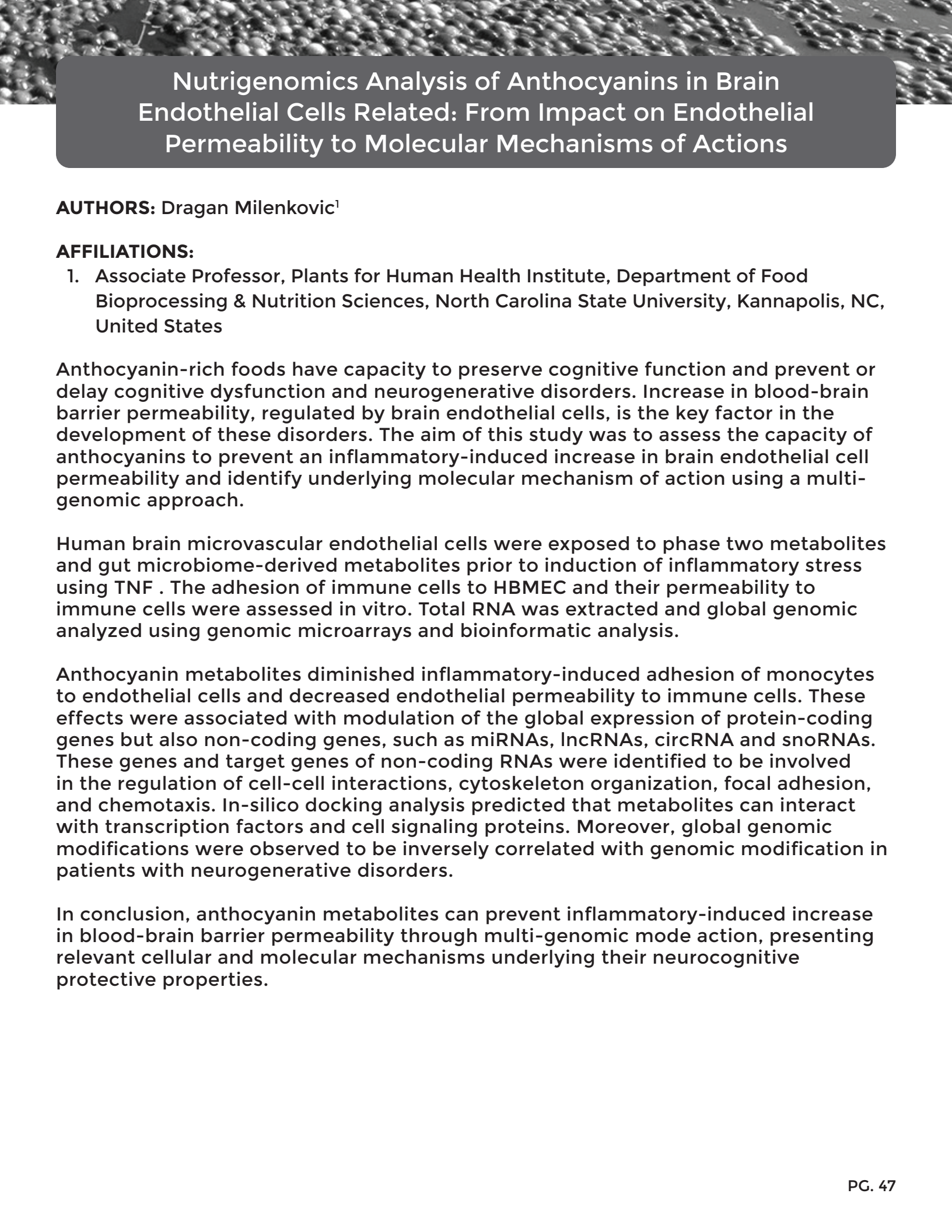
Hypertension (HTN) and type 2 diabetes mellitus (T2DM) are highly prevalent, interrelated conditions that substantially increase the risk of cardiovascular disease, the leading cause of death worldwide. Beyond cardiovascular complications, individuals with HTN and T2DM face an elevated risk of cognitive decline, and growing evidence indicates that intestinal microbiota can contribute to both the development and progression of these conditions. Lifestyle interventions, particularly dietary strategies that increase consumption of fiber- and phytochemical-rich foods such as berries, hold promise for improving cardiometabolic, cognitive, and intestinal health. To address this, we investigated the effects of diet enrichment with berries in both animal and human studies. Diet enrichment with blackberry (BL) or red raspberry (RB), alone or in combination, attenuated increases in blood pressure and shifted microbial composition, including a lower Bacillota to Bacteroidota ratio in a mouse model of HTN. Genetically heterogeneous mice fed a high-fat, high-sugar, and high-salt diet enriched with wild blueberries (WB) for 16 weeks had improved cardiac function, enhanced microbial diversity, and distinct behavioral responses suggestive of cognitive benefits. Building on these preclinical findings, two ongoing clinical trials are testing daily WB intake in humans: an 8-week randomized, crossover, placebo-controlled trial in non-Hispanic Black and White adults with HTN (NCT06735599) and a 6-week randomized, parallel, placebo-controlled trial in female adults with prediabetes (NCT06735651) - both designed to assess the beneficial impact of WB on cardiometabolic, intestinal, and cognitive function outcomes in these populations. Together, our preclinical findings highlight the potential of berry-enriched diets to improve cardiometabolic, intestinal, and cognitive health, and ongoing clinical studies will help determine how these effects translate to humans, advancing understanding of dietary strategies for prevention and management of HTN and T2DM.

FUNDING DISCLOSURE: *NIFA-USDA, Wild Blueberry Association of North America, GSU Brains & Behavior, and GSU Lewis College Foundation*



Dr. Dragan Milenkovic
North Carolina State University

Dr. Dragan Milenkovic is Associate Professor at Plant for Human Health Institute at North Carolina State University, Kannapolis, NC, USA. Before that he was a Faculty Researcher at the Department of Nutrition at University of California Davis, Davis, CA, USA, and beforehand a Scientific Research at French Institute for Agricultural research. He received his master's degree in genetics and molecular modelling from University of Paris, France, and his PhD from University of Versailles, France, in molecular genetics. His research aims to demonstrate health effects of micronutrients, particularly polyphenols, on (neuro)vascular function and development and/or prevention of cardiovascular and neurodegenerative diseases, as well as identify underlying cellular and molecular mechanisms of action using integrated multiomics and bioinformatics. His projects also aim to identify variability in responsiveness to intake of these nutrients and identify factors involved, such as gender, age, health status or genetic polymorphism. His projects use translational research approach involving in-vitro studies, animal models and clinical trials. He has published over 120 research papers and has over 8, 000 citations.



Nutrigenomics Analysis of Anthocyanins in Brain Endothelial Cells Related: From Impact on Endothelial Permeability to Molecular Mechanisms of Actions

AUTHORS: Dragan Milenkovic¹

AFFILIATIONS:

1. Associate Professor, Plants for Human Health Institute, Department of Food Bioprocessing & Nutrition Sciences, North Carolina State University, Kannapolis, NC, United States

Anthocyanin-rich foods have capacity to preserve cognitive function and prevent or delay cognitive dysfunction and neurogenerative disorders. Increase in blood-brain barrier permeability, regulated by brain endothelial cells, is the key factor in the development of these disorders. The aim of this study was to assess the capacity of anthocyanins to prevent an inflammatory-induced increase in brain endothelial cell permeability and identify underlying molecular mechanism of action using a multi-genomic approach.

Human brain microvascular endothelial cells were exposed to phase two metabolites and gut microbiome-derived metabolites prior to induction of inflammatory stress using TNF . The adhesion of immune cells to HBMEC and their permeability to immune cells were assessed in vitro. Total RNA was extracted and global genomic analyzed using genomic microarrays and bioinformatic analysis.

Anthocyanin metabolites diminished inflammatory-induced adhesion of monocytes to endothelial cells and decreased endothelial permeability to immune cells. These effects were associated with modulation of the global expression of protein-coding genes but also non-coding genes, such as miRNAs, lncRNAs, circRNA and snoRNAs. These genes and target genes of non-coding RNAs were identified to be involved in the regulation of cell-cell interactions, cytoskeleton organization, focal adhesion, and chemotaxis. In-silico docking analysis predicted that metabolites can interact with transcription factors and cell signaling proteins. Moreover, global genomic modifications were observed to be inversely correlated with genomic modification in patients with neurogenerative disorders.

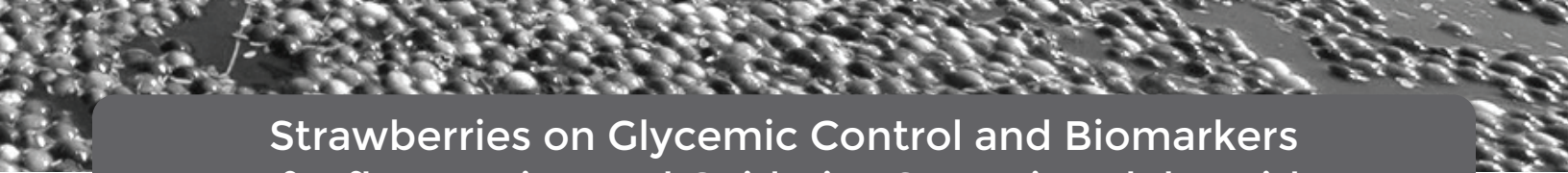
In conclusion, anthocyanin metabolites can prevent inflammatory-induced increase in blood-brain barrier permeability through multi-genomic mode action, presenting relevant cellular and molecular mechanisms underlying their neurocognitive protective properties.



Dr. Arpita Basu
University of Nevada, Las Vegas

Associate Professor Arpita Basu joined the Kinesiology and Nutrition Sciences Department during fall 2017 and teaches nutrition and metabolism, epidemiology of nutrition and physical activity, and related metabolism and public health courses within the undergraduate and graduate programs. Basu's research focuses on understanding the health effects of dietary bioactive compounds, such as those found in fruits and beverages in modulating disease biomarkers in type 2 diabetes, hypertension, and cardiovascular disease (CVD). She has conducted several clinical trials focused on these foods, beverages, and dietary supplements among adults with the metabolic syndrome, type 2 diabetes, and CVD risks. Basu also has extensive research interests in diabetes and nutritional epidemiology and has published several reports about prospective associations of lipid and lipoprotein biomarkers, and of dietary patterns, with diabetes vascular complications. Prior to coming to UNLV, Basu was a tenured faculty member in Nutritional Sciences at Oklahoma State University for 10 years. She has been published in more than 100 peer-reviewed journal articles and invited book chapters. Her research has been funded by federal and industrial agencies.

Basu earned her master's in food and nutrition from University of Calcutta India, her master's in public health with focus on epidemiology from University of South Florida, and her Ph.D. in nutrition from Texas Woman's University. She completed her postdoctoral fellowship in clinical nutrition at University of California Davis Medical Center. Basu serves on the editorial boards of the Journal of Nutrition, Journal of Clinical Endocrinology and Metabolism, and Critical Reviews in Food Science and Nutrition. Basu is also a registered and licensed dietitian and practices within the clinical research areas of diabetes and related cardiometabolic conditions.



Strawberries on Glycemic Control and Biomarkers of Inflammation and Oxidative Stress in Adults with Prediabetes: A Randomized Controlled Crossover Trial

AUTHORS: Arpita Basu, PhD, RD¹

AFFILIATIONS:

1. Associate Professor, Kinesiology and Nutrition Sciences, University of Nevada, Las Vegas

Dietary berries are a rich source of nutrients and phytochemicals, and accumulating evidence suggests they can reduce risks of several chronic diseases, including type 2 diabetes (T2D).¹ However, their effects on biomarkers of glycemic control, especially glycated hemoglobin and blood glucose, are quite inconsistent, and this is mainly due to the large number of clinical trials being conducted in overweight or obese adults with otherwise normal glycemic control, as well as the large variation in berry products and doses used.² The objective of this presentation is to summarize and discuss the role of dietary berries on insulin resistance and biomarkers of T2D in human feeding studies, especially focusing on our recent work in strawberries. Commonly consumed berries, especially blueberries, cranberries, raspberries, and strawberries, ameliorate postprandial hyperglycemia and hyperinsulinemia in overweight or obese adults with insulin resistance, and in adults with the metabolic syndrome in a few trials.³⁻⁵ In our previously reported trial, 2.5 servings of strawberries decreased insulin resistance and fasting insulin and revealed a borderline decrease in serum LDL-cholesterol in adults with prediabetes in a four-week trial for each arm.⁶ In our recently reported 28-week randomized crossover study, the same dose of strawberries showed significant improvements in fasting glucose, glycated hemoglobin, and insulin resistance when compared to the no-strawberry control group, each for 12 weeks.⁷ In non-acute long-term studies, these berries either alone, or in combination with other functional foods or dietary interventions, can improve glycemic and lipid profiles, blood pressure and surrogate markers of atherosclerosis. Future dose-response studies must focus on adults with prediabetes or impaired glucose tolerance as an independent risk factor for T2D.

KEYWORDS: Strawberries, prediabetes, glycated hemoglobin, insulin resistance, randomized controlled trial

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Wednesday, October 8th
Junior Investigator Oral Presentations

BHBS Junior Investigator Program

The 2025 Berry Health Benefits Symposium is pleased to offer two ways for students of berry science to share their latest research findings. Graduate students and postdoctoral fellows were invited to submit abstracts for review and consideration for both Poster Presentations and Oral Presentations at this years symposium.

These Junior Investigators submitted original research relating to the symposium themes of gut health, cardiovascular health, cognitive health, and other health properties of berry fruit.

The following abstracts were selected for the 3 oral presentations followed by the additional abstracts that were reviewed and accepted as posters. The winner of the “Most Outstanding Poster” award will be announced after the Junior Investigator Oral Presentations taking place in the afternoon on Wednesday, October 8th.



Yudai Huang
Illinois Institute of Technology

Yudai Huang is a PhD candidate in the department of Food Science and Nutrition at the Illinois Institute of Technology. Her research focuses on identification and quantification of human metabolites after consuming phytochemical-rich foods. In addition, she is interested in understanding inter-individual variability in responses to foods using metabolomics and machine learning approaches.

A Predictive Modeling Approach for Urolithin Producer Status in Response to Strawberry and/or Red Raspberry Consumption

Authors: Yudai Huang¹, Indika Edirisinghe¹, Britt Burton-Freeman¹, Amandeep Sandhu¹

Affiliation:

1. Department of Food Science and Nutrition and Center for Nutrition Research, Institute for Food Safety and Health, Illinois Institute of Technology, Chicago, IL, USA

INTRODUCTION: Strawberries and red raspberries are rich sources of ellagitannins (ETs). After consumption, ETs are metabolized by gut microbiota to produce different urolithins. Urolithins and their derivatives exhibit antioxidative, anti-inflammatory and other beneficial health effects; however, substantial inter-individual variability exists in urolithin production among humans.

OBJECTIVE: This study aimed to develop a predictive model to classify urolithin producer status using baseline clinical and metabolite data. If successful, this approach could tailor dietary guidance toward individuals who are most likely to benefit from these foods, including how much they need to eat to produce health promoting urolithin compounds.

METHODS: Data were compiled from four clinical studies using strawberries or/and red raspberries as a food intervention for 4-week. A total of 158 participants who received berry intervention were included. Urolithin producer status was defined according to metabolite profiles at study completion. Predictors were derived from baseline features that consistently measured in all four studies, including 19 phenolic acid concentrations, metabolic markers, dosage of ellagitannins and demographic information. Four supervised learning algorithms were evaluated: logistic regression, random forest, XGBoost and a stacked ensemble combining XGBoost and logistic regression. Cross-validation with hyperparameter tuning was applied. Model performance was assessed using weighted precision, F1-score, the area under the receiver operating characteristic (ROC) curve.

RESULTS: Data from the analytical analysis revealed that among 158 participants, 110 were urolithin producers and 48 participants did not produce any urolithin after 4-week consumption of strawberries and/or red raspberries. Twelve of the original baseline features were retained for modeling, including ET dosage, 8 phenolic acid concentrations, age, HDL and fasting glucose levels. The area under the ROC curves were 0.638, 0.675, 0.691 and 0.737 for random forest, XGBoost, logistic regression and stacked XGBoost and logistic regression, respectively. The stacked ensemble model achieved the best predictive performance, with 0.75 for weighted precision and f1-score.

CONCLUSION: This study demonstrates the feasibility of applying machine learning to predict urolithin producer status from baseline clinical data. The predictive model has the potential to differentiate individuals who would benefit more from the intake of ET-rich foods. These preliminary findings support further development of predictive models with larger datasets to advance precision nutrition.

Wednesday, October 8th

Junior Investigator Oral Presentations



Morganne Smith
Illinois Institute of Technology

Morganne Smith is a PhD candidate in Food Science and Nutrition at Illinois Institute of Technology and a research associate at the Clinical Nutrition Research Center, IIT. She studies how diet shapes the gut microbiome and its metabolites, such as bile acids, to influence metabolic health.

Berry (Poly)phenols with and without Fructo-Oligosaccharide on Gut Microbial Activity in Adults with Low-Grade Inflammation

AUTHORS: Morganne M. Smith¹, Yudai Huang¹, Adit Chaudhary^{2,3}, Ankur Naqib³, Indika Edirisinghe¹, Britt M. Burton-Freeman¹, Amandeep K. Sandhu¹

AFFILIATION:

1. Department of Food Science and Nutrition and Center for Nutrition Research, Institute for Food Safety and Health, Illinois Institute of Technology, Chicago, IL, USA
2. Genomics and Microbiome Core Facility, RUSH University, Chicago, IL, USA
3. RUSH Research Bioinformatics Core, RUSH University, Chicago, IL, USA

OBJECTIVES: This research evaluated the impact of a mixed berry beverage (strawberry and red raspberry), fructo-oligosaccharide (FOS), and their combination on gut microbial community composition and gene expression patterns in adults with low-grade inflammation, as part of a larger study investigating the role of diet-microbiome interactions in mechanisms of inflammation.

METHODS: This was a 4-week randomized, parallel, single-blinded, placebo-controlled study (Clinicaltrials.gov NCT04100200) where participants (n=92, hs-CRP>1.0 mg/L, Age: 35 ± 13 years, BMI: 29.8 ± 4.5 kg/m²; mean ± SD) were asked to consume one of four beverages daily for 4 weeks as part of their usual diet: mixed berries (MBS), fructo-oligosaccharide (FOS), MBS + FOS or a control. Fecal samples collected at baseline (Wk 0) and post-intervention (Wk 4) were analyzed by metagenomic and metatranscriptomic sequencing to assess microbial composition and activity. Metagenomic differential abundance was tested using centered log-ratio transformed Kruskal-Wallis (CLR-KW) tests with false discovery rate (FDR) adjustment (significance at q < 0.05). Metatranscriptomic differential abundance was assessed using MaAsLin2 mixed-effects models (significance at q < 0.25; trends at p < 0.1, defined a priori), and feature selection was confirmed with Boruta.

RESULTS: Metagenomic analyses indicated modest changes in taxonomic composition with a greater abundance of Firmicutes in the MBS group compared to the MBS+FOS group at the phylum level, and a greater abundance of Bifidobacterium longum in the FOS group compared to the MBS group at the species level (CLR-KW, FDR-adjusted q < 0.06). However, metatranscriptomic analyses indicated stronger group-specific shifts in active microbial taxa. In the MBS group, Clostridium increased significantly (MaAsLin2 mixed-effects model, FDR-adjusted q < 0.25) after 4 weeks compared to baseline, including enrichment of Clostridium fessum and Clostridium sp. AF15 49 species. Other within group comparisons included increased activity of Parabacteroides in Control+FOS, decreased Mediterraneibacter in Control+FOS and MBS+FOS, and increased Sutterella in MBS+FOS (MaAsLin2 mixed-effects model, p < 0.1). Between-group comparisons showed differential enrichment of several taxa (p < 0.1), including Bifidobacterium in both the Control+FOS and MBS+FOS groups compared to MBS, Bilophila in the MBS group compared to MBS+FOS, and Faecalibacterium in the MBS+FOS group compared to control. Feature selection (Boruta) confirmed intervention-specific signatures of microbial species that were significantly associated with each study intervention. These included Clostridium fessum (MBS), Parabacteroides merdae (Control+FOS), Collinsella aerofaciens (MBS+FOS) and Bacteroides ovatus (Control).

CONCLUSIONS: These findings suggest that the mixed berry beverage influences gut microbiome composition and modulates microbial activity. While microbial structural shifts were modest, changes in microbial activity may impact metabolite production and inflammatory pathways, highlighting the importance of functional assessments such as metatranscriptomics in dietary intervention studies.

SOURCE OF FUNDING: This work is supported by the Agricultural and Food Research Initiative {grant no. 2019-67017-29254/ project accession no. 1018625} from the USDA National Institute of Food and Agriculture.



Azeezat Abdus-Salam Georgia State University

Azeezat is a doctoral student in Chemistry with a concentration in Nutritional Sciences at Georgia State University where she conducts research in Molecular and Clinical Nutrition under the mentorship of Dr. Rafaela G. Feresin. Her research focuses on metabolism and dietary interventions for metabolic disorders and currently explores the health benefits of blueberry polyphenols in insulin signaling and energy metabolism in a western diet-fed mice model.

Hepatoprotective Effects of Wild Blueberries in Mice Fed a Western Diet

AUTHORS: Azeezat F. Abdus-salam,^{1,2,3} Jessica P. Danh,^{1,3} Sheryl Varghese,^{1,3} Toba A. Omotosho,^{1,2,3} Cameron M. McCarthy,^{1,3} Desiree Wanders,^{1,2,3} Rafaela G. Feresin^{1,2,3}

AFFILIATION:

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2. Department of Biology, Georgia State University, Atlanta, GA, USA
3. Department of Chemistry, Georgia State University, Atlanta, GA, USA

BACKGROUND: The western diet high in fat, sugar, and salt promotes the development of metabolic liver diseases through increased oxidative stress, inflammation, and dysregulated energy metabolism. Wild blueberries (WBB) may offer hepatoprotective benefits via their antioxidant properties. Here, we examined the effects of diet enrichment with WBB on markers of hepatic oxidative stress, insulin signaling and extracellular matrix (ECM) components in mice consuming a high-fat, high-sucrose, high-salt (HFHSS) diet.

METHODS: Four-week-old UM-HET3 male mice (n = 10 per group) were randomly assigned to consume a low-fat, low-sucrose, low-salt (LFLSS) alone or supplemented with 5% (w/w) WBB (LFLSS + WBB) for four weeks. Then, LFLSS either continued with that intervention or were randomized to HFHSS while LFLSS + WBB was switched to HFHSS + WBB (5% w/w) for 12 weeks. Liver was collected at sacrifice for analysis of protein and gene expression of hepatic markers of oxidative stress, energy metabolism and ECM components. Liver sections were also fixed, paraffinized and used for histological evaluation and immunohistochemical detection of oxidative stress markers. Normality was assessed using Shapiro-Wilk test. Data were analyzed using one-way ANOVA or Kruskal-Wallis followed by Tukey's or Dunn posthoc test.

RESULTS: HFHSS diet increased hepatic expression of NADPH oxidase (NOX)1 ($p \leq 0.02$) but had no effect on NOX4 or xanthine oxidase (XO). while decreasing the expression of nuclear factor erythroid 2-related factor (Nrf2) ($p=0.06$) compared with the HFHSS + BB. This decrease was accompanied by reduced expression of antioxidant enzymes glutathione peroxidase (GPx)-1, (GPx) -3 ($p \leq 0.01$) and superoxide dismutase (SOD)2 ($p=0.06$). WBB significantly increased GPx-1 expression ($p \leq 0.03$) compared to HFHSS group ($p \leq 0.03$) compared to HFHSS group but did not attenuate the reduction GPx-3 and SOD2 expression. WBB attenuated the increase in oxidative stress, as measured by 4-hydroxynonenal (4HNE) and nitrotyrosine (NT) induced by a HFHSS. WBB showed modulated gene expression of insulin-like growth factor IGF1 and its binding protein (IGFBP-1). Protein Kinase B (AKT) expression was reduced by the HFHSS ($p \leq 0.04$), indicating possible impairment in insulin signaling but this effect was not prevented by WBB. In the HFHSS group, Foxo1, a gluconeogenesis and apoptosis regulator, and Srebp1, a lipogenic transcription factor, were upregulated, while Pgc1, a marker of mitochondrial biogenesis, was downregulated; WBB supplementation partially reversed these HFHSS-induced effects. HFHSS diet significantly increased the expression of p-AMPK/AMPK ratio, ($p \leq 0.004$) and this increase was significantly reduced by WBB ($p \leq 0.02$). WBB did not attenuate markers of inflammation or ECM. HFHSS showed increased gene expression for collagen type 3, however not significantly ($p \leq 0.07$)

CONCLUSION: Our findings highlight WBB as a promising dietary strategy to mitigate western diet hepatic dysfunction. Further studies are warranted to clearly understand the mechanism of action.

Poster Presentation Abstracts

Comparisons of Different Categories of Blueberries on Bioactive Compounds Profiles and Anti-aging Effects

AUTHORS: Fnu Annu¹, Yang Zhang¹, Hongwei Si¹

AFFILIATION:

1. Department of Food and Animal Science, Tennessee State University, Nashville, TN, USA 37209

INTRODUCTION: Blueberries are called “Super fruits” because of their high potential health benefits for a variety of chronic diseases, such as cardiovascular disease, diabetes, obesity, and neurological disorders. However, the extensive range of the bioactive compounds in different blueberries (wild vs. cultivated, highbush vs. lowbush) deters customers’ selection and consumption of blueberries.

METHODS: We performed a comprehensive analysis of the bioactive compound profiles in wild, highbush, and rabbit eye blueberry powders using HPLC for epicatechin and colorimetric assays for total phenolics and total flavonoids. To investigate their potential survival and anti-aging effects, 20-month-old C57BL/6J mice, including males and females, were assigned to dietary groups receiving either a control diet or supplementation with 10% wild, highbush, or rabbit eye blueberry powder or 0.25% epicatechin (EC). Survival was monitored throughout all the diet groups and was observed daily, and the weight, food intake, and date of natural death were recorded for each mouse. Physical functions were assessed using both treadmill exhaustion testing and voluntary running wheel experiments. Group comparisons were analyzed using Dunnett’s t-tests in SAS, with significance set at $p < 0.05$.

RESULTS: Our results indicated that the total phenolics, total flavonoids, and EC are significantly different between different berries. For instance, EC levels are 99.89 mg/g, 54.05 mg/g, and 46.33 mg/g in wild, highbush, and rabbiteye blueberries, respectively. For the treadmill exhaustion test, all blueberry-supplemented groups were significantly different ($p < 0.05$) from the control, with improved running distance to exhaustion (198.1, 236, 251.3, 254, & 248.4 meters in the control, wild, highbush, rabbit eye blueberry & epicatechin, respectively). Similarly, the wild blueberry group is significantly different from the control in the voluntary running wheel time (9.5 & 52.95 minutes per day in the control and wild blueberry, respectively, $p < 0.05$). In addition, all dietary intakes of the blueberries group significantly improved survival rates compared with the control group in male mice (60.7, 78.5, 82.1, 57.1, and 67.8% in the control, wild, highbush, rabbit eye blueberry and epicatechin, respectively).

CONCLUSION: The results of this study provide a solid scientific rationale for recommending the dietary intake of blueberries as a strategy to promote a healthy lifespan. Moreover, this study suggests that distinct blueberry categories may have different anti-aging effects likely attributable to their unique phytochemical compositions.

KEYWORDS: Nutrition, Blueberries, bioactive compounds, anti-aging.



Development of a Multi-Berry Functional Food for Cognitive Health

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ABSTRACT:

Neurological deficits, including cognitive decline, mood disorders, and decreased attention pose significant public health challenges. Research suggests that dietary interventions may play a crucial role in mitigating these deficits through the gut-brain axis, a two-way signaling pathway between the nervous system and gut microorganisms. This work aims to develop a functional food designed to support neurological health using a combination of bioactive compounds found in foods that will be used in future clinical studies. Polyphenols and carotenoids have both been studied independently to provide neuroprotection. However, there is a dearth of information on their role in improving cognitive impairment in a clinical setting especially when combined, and whether they display a synergistic effect when studied *in vivo*. To address this research gap, a novel functional snack was formulated by incorporating freeze-dried whole berry powders (strawberry, blueberry, and black raspberry) and marigold-derived lutein as phytochemical sources within an aquafaba-based matrix. The contrasting hydrophobic properties of these phytochemical classes required strategic formulation approaches to optimize homogeneity and stability within the food matrix. Sensory evaluation across four iterations using Overall Liking and Just-About-Right (JAR) scales for six unique sensory attributes was performed to identify the preferred formulation by consumers. Penalty analysis determined that the two attributes, sweetness and flavor intensity, were significantly below JAR levels, resulting in mean drops in overall liking. The formulation was subsequently adjusted to align with consumer preferences. Optimal polyphenol extraction conditions were determined and subsequently used for further analysis of the preferred modified formulation identified during the sensory evaluation. Nutritional values were calculated and adjusted to ensure the formulation's caloric content was appropriate for a clinical-trial intervention and that major allergens did not pose a significant concern. The different berry varieties in the product yielded total polyphenol concentrations ranging from 794.1 to 1875.9 mg gallic acid equivalents per 100 grams of dry weight, placing one serving within the beneficial daily polyphenol intake range associated with cognitive benefits based on previous research. Non-anthocyanin phenolic classes were extracted with ethyl acetate and saved for further analysis to better understand the diverse polyphenol profile across the three berries. Future work includes quantifying total monomeric and individual anthocyanins using the pH differential method and high-performance liquid chromatography (HPLC), respectively. This preliminary work will provide the foundation for the conduction of a Phase I clinical trial to assess the bioaccessibility and bioavailability of the phytochemicals, as well as their potential to improve cognitive function.

Inhibition of Trimethylamine Production *In Vitro* Does Not Differ in Blueberries with Varying Chlorogenic Acid Content

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ABSTRACT:

Cardiovascular diseases (CVDs) account for ~32% of all deaths worldwide, and atherosclerosis-related conditions are the leading cause of death in the United States. Elevated blood levels of trimethylamine N-oxide (TMAO), a gut microbiota-derived metabolite are linked to increased risk of atherosclerosis. TMAO is produced when gut bacteria metabolize dietary quaternary amines to trimethylamine (TMA), which is converted to TMAO in the liver. With no FDA-approved drugs available to reduce TMA or TMAO, dietary interventions present the most promising strategy. Chlorogenic acid (CGA), a phenolic abundant in blueberries, inhibits TMA production. Blueberries may thus be a TMA (and TMAO)-lowering food. CGA content in blueberries varies depending on cultivar, growth conditions, and storage conditions; it remains unclear whether these variations in CGA levels influence the TMA-lowering activity of different blueberry varieties. We investigated the impact of blueberry CGA content on the inhibition of choline-d₉ conversion to TMA-d₉ in our *ex vivo-in vitro* human fecal fermentation model. We tested blueberry skins (to avoid interferences from sugar-rich pulp) from 20 genetically distinct blueberry genotypes, chosen based on their high and low CGA content. CGA levels in whole berries ranged from 2.6-146 mg/100 g fresh weight (FW), while CGA concentrations in skins ranged from 0.14-9.7 mg/g. No significant differences were observed in TMA-d₉ production among the 4 highest and 4 lowest CGA genotypes in kinetic curves or area under the curve values. However, significant differences were observed between all cultivars compared to controls with ~21.75% reduction in TMA AUCs, indicating that phenolic-rich skin provides similar TMA-lowering benefits across blueberry varieties. This suggests that CGA content of cultivars is not a crucial factor for lowering TMA. Preliminary evidence suggests that fiber is also not the primary driver of the inhibitory activities of blueberry skins. Future studies, including rodent and human studies, are needed to confirm this *in-vitro* study and understand why blueberries may inhibit TMA and potentially TMAO, as *in vitro* studies have limitations, and the mechanism of TMA production remains unclear.

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Blueberry Pyranoanthocyanins Surpass Efficacy of Anthocyanins in Reduction of Inflammation Under Hypoxic Conditions *in vitro*

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BACKGROUND: Oxygen deficient environment (hypoxia) induces key inflammatory processes in chronic and degenerative diseases by activating inflammatory NF- κ B transcription factor and STAT3. Both NF- κ B and STAT3 regulate genes involved in inflammation, cell survival and tumor progression making them key targets in glioblastoma research. Berries are rich in anthocyanins, the pigments responsible for their blue, purple and red colors and studies have shown that these compounds can modulate inflammation through NF- κ B and STAT3 signaling. Pyranoanthocyanins are pigments formed when anthocyanins react with other secondary metabolites, resulting in increased color stability, however, limited information is available about their bioactivity.

OBJECTIVE: To evaluate and compare anti-inflammatory activity of berry anthocyanins and pyranoanthocyanins in experimentally induced in-vitro hypoxic conditions by assessing NF- κ B activation and STAT3 expression.

METHODS: Anthocyanins from highbush blueberries and blackcurrant were extracted and semi-purified using solid phase extraction, mixed with 4-vinylphenol (3:1 molar ratio, pH 3.1) and incubated at 45°C for 4 days to produce Pyranoanthocyanins. Identities and purity were confirmed via UHPLC-PDA-ESI-MS/MS. Inflammatory responses were assessed using 3T-L1NFRE preadipocytes expressing green fluorescence protein (GFP) upon NF- κ B activation and normalized protein concentration. Cells were treated with anthocyanins or pyranoanthocyanins (0 - 100 nM) during differentiation under normoxic or cobalt chloride-induced hypoxic conditions. STAT3 activity was evaluated using HEK Blue reporter cells exposed to conditioned media from treated U87 glioblastoma cells, with secreted embryonic alkaline phosphatase (SEAP) quantified by a calorimetric assay. All experiments were performed in five independent replications.

RESULTS: Hypoxic conditions resulted in a significant reduction in cell number, cell size and showed higher NF- κ B stimulation. Both anthocyanins and pyranoanthocyanins treatment decreased NF- κ B stimulation however pyranoanthocyanins demonstrated 2-fold greater reduction of NF- κ B stimulation as compared to anthocyanins ($p = 0.0003$). This effect was observed at a low 9nM concentration, reducing inflammation by 50%, highlighting their anti-inflammatory efficacy. Conditioned media from blueberry pyranoanthocyanins-treated cells significantly reduced STAT3 activation ($p = 0.0001$), further supporting their anti-inflammatory potential in hypoxic glioblastoma.

CONCLUSION: Pyranoanthocyanins, particularly those derived from blueberries outperformed anthocyanins in reducing inflammation under hypoxic conditions by suppressing both NF- κ B and STAT3 activation. These findings suggest that structural modifications of anthocyanins, such as the formation of pyranoanthocyanins, may enhance their bioactivity. This study highlights the potential of blueberry pyranoanthocyanins in modulating key inflammatory pathways relevant to chronic diseases and tumor-associated inflammation.

ERROR ANALYSIS: Data were expressed as mean $\pm$ SEM of 5 replications and analyzed using Student's t-test ($p < 0.05$). While blueberry pyranoanthocyanins significantly reduced both NF- κ B activation and STAT3 expression under hypoxia, suppression of STAT3 was not observed with blackcurrant pyranoanthocyanins. This deviation may have resulted from differences in the composition of parent anthocyanins, which could have influenced pyranoanthocyanin properties such as cellular uptake and bioactivity. The absence of NF- κ B data for blackcurrant pyranoanthocyanins limited direct comparison and variability in compound composition or cell permeability may have influenced the differential STAT3 response.

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Dietary Blueberries Delay Aging-induced Cognitive Function in Mice: Comparison of Different Blueberry Categories

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INTRODUCTION: Blueberries are rich in anthocyanins and flavonoids with strong antioxidants and anti-inflammatory activity, which may improve brain function. However, most research uses one category of blueberry and there are big different profiles of phytochemicals among different categories of blueberries such as wild, highbush, and rabbiteye blueberries. It is crucial to compare whether different categories of blueberries delay aging-induced brain dysfunction similarly or differently.

METHODS: C57BL/6J mice (male and female), including aged (20-month-old) and young (10-month-old) were fed for 16-20 weeks of dietary intervention by five groups: control, wild blueberry (WB), highbush blueberry (HB), rabbiteye blueberry (RB), and epicatechin (EC). Cognitive performance was tested using the Morris water maze (MWM) for spatial memory and the open field (OF) for anxiety-like behavior. Following behavioral tests, brains were dissected for RNA sequencing to examine transcriptomic changes and western blotting to evaluate proteins related to synaptic plasticity, neuroinflammation, and oxidative stress defense. Group comparisons were performed using two-tailed Welch's t-tests (unequal variance) in Excel, with significance set at $p < 0.05$.

RESULTS: In the open field test, young male mice exposed to WB and HB showed a significant reduction in border zone entries (Control: 117.5 ± 6.4 ; WB: 86.9 ± 7.8 ; HB: 65.4 ± 17), indicating decreased anxiety-like behavior ($p < 0.05$). In aged female mice, WB, HB, RB, and EC also reduced anxiety-like behaviors, as evidenced by increased periphery (middle region between border and center) time (e.g., $893.2-896.5s$, $p < 0.05$) than control mice ($822.9s$). In the Morris water maze probe test, all treatment groups showed greater platform crossings than controls, with RB having the highest values; although p-values were > 0.05 , the trend suggests improved memory retention compared to controls. In addition, all blueberry and EC groups showed shorter latencies (in seconds) to reach the target platform compared to controls, with control ($82.4 \pm 12.3s$), RB ($43.2 \pm 13.3s$, $p = 0.08$), and EC ($50.1 \pm 7.9s$, $p = 0.068$) showing more substantial improvement of aging-induced memory reduction.

CONCLUSIONS: RB showed the most substantial improvement in memory retention, while WB and HB had modest effects. Therefore, different blueberry categories may vary in their potential to delay aging-related brain dysfunction.

KEYWORDS: Blueberries, Category, Morris Water Maze, Open Field.

Notes

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