2024 NUTRITION SYMPOSIUM

30th Anniversary

April 12th & 13th

University of Illinois Urbana-Champaign
College of Agricultural, Consumer & Environmental Sciences | Division of Nutritional Sciences

College of Agricultural, Consumer & Environmental Sciences
Division of Nutritional Sciences

NSGSA
Nutritional Sciences Graduate Student Association

On behalf of the Nutritional Sciences Graduate Student Association (NSGSA), the Division of Nutritional Sciences (DNS), and all participating presenters, we would like to welcome you to the 2024 Nutrition Symposium at the University of Illinois Urbana-Champaign. We are delighted to announce that this year's event will celebrate 30 years of the Nutrition Symposium!

The Nutrition Symposium is an important event for sharing ideas across disciplines and with the community. Organized for the first time in 1994 by NSGSA, the symposium offers graduate students with nutrition-related research on campus an opportunity to present prior to annual national and international scientific meetings and conferences. This symposium offers a first glance at exciting research in areas including metabolic regulation, cancer, gastrointestinal physiology, immunology, physical activity, public health, and bioactive plant compounds. Students will be traveling to present their work at a variety of national and international conferences.

This year, we are honored to have Dr. Cheryl Anderson deliver the keynote address. Dr. Anderson is Professor and Dean of the Herbert Wertheim School of Public Health and Human Longevity Science at the University of California, San Diego (UCSD). She is the Director of the UCSD Center of Excellence in Health Promotion and Equity, a Fellow of the American Heart Association, a member of the 2015 and 2020 US Dietary Guidelines Advisory Committees, and an elected member of the National Academy of Medicine. The title of her keynote presentation is "Diet and Cardiovascular Health: Epidemiology, Equity, and Enacting Change."

NSGSA is also proud to highlight the work of world-class faculty members through a mini-symposium. This year's presentations feature Drs. Hans H. Stein, M. Yanina Pepino, and John W. Erdman Jr., whose presentations will highlight the theme of this year's symposium: From Seed to Pearls: Celebrating 30 years of Nutrition Science Research at UIUC.

We are grateful to the many people involved with this meeting and program. We would first like to thank our keynote speaker, Dr. Cheryl Anderson. Thank you also to our sponsors – their support is essential to the success and quality of the program. We would also like to recognize the NSGSA Steering Committee and the Symposium Planning Committee, whose members have worked long and hard to organize an excellent program, as well as Conference and Event Services, who have worked with us to be able to organize a high-quality event. Most of all, we would like to thank our session chairs, judges, presenters, and attendees for participating in this year's event and making it a success.

The Nutritional Sciences Graduate Student Association Chair and Chair-Elect

nutrsci.illinois.edu

(Cover Image) A vivid spectrum of colors are observed from the extraction of organic compounds from material as displeasing as fecal matter.

Research image by Alexis Baldeon

The Nutritional Sciences Graduate Student Association (NSGSA) was founded in the spring of 1973 by students in the program. The mission of the organization is to provide a means of communication among graduate students, faculty, and alumni of the Division of Nutritional Sciences (DNS), which spans multiple colleges and departments.

NSGSA serves as a forum for student opinion and input and provides students the opportunity to expand their experiences as graduate students. Our activities reflect our desire to enrich our experiences as graduate students and promote the importance of the nutritional sciences discipline both within the university and among the surrounding communities of Champaign and Urbana.

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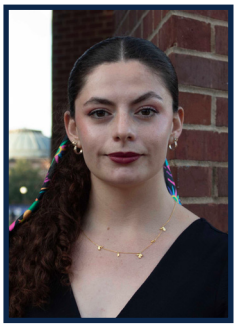


Ximena Yrigoyen
New Student Representative & Representative to the Faculty

NSGSA Steering Committee photographs by Cameron Scharff

Friday, April 12th, 2024

†**2:00 p.m. – 2:30 p.m.** ..... **Welcome**
Alex Baldeon – Chair, NSGSA
Dr. Kelly Swanson – Director, DNS
Dr. Marcia Monaco Siegel – Member, NSGSA 1994
2025A, Student Dining and Residential Program Building

†**2:30 p.m. - 2:50 p.m.** ..... **Outstanding Faculty Award Presentation**
Presented by Nadine Veasley – Chair-Elect, NSGSA
2025A, Student Dining and Residential Program Building

†**2:55 p.m. – 4:55 p.m.** ..... **Faculty Symposium: From Seed to Pearls**
2025A, Student Dining and Residential Program Building
2:55 - 3:30: Dr. Hans H. Stein
3:30 - 4:05: Dr. M. Yanina Pepino
4:05 - 4:20: Break
4:20 - 4:55: Dr. John W. Erdman Jr.

***5:30 p.m. – 7:30 p.m.** ..... **Symposium Social**
Heritage Room, ACES Library

* In-person attendance requires registration
† Streamed session for virtual attendees

Saturday, April 13th, 2024

***9:15 a.m. – 9:55 a.m.** ..... **Breakfast/Welcome Reception**
Heritage Hall 3, iHotel & Illinois Conference Center

†10:00 a.m. - 11:00 a.m. ..... **Oral Session 1: Cancer, the Gut-Brain Axis, and Sensory Nutrition**
Heritage Hall 6, iHotel & Illinois Conference Center
10:00 - 10:15: Angela Dean
10:15 - 10:30: Jessica G. Nicanor-Carreon
10:30 - 10:45: Zainab Alzoubi
10:45 - 11:00: Benjamin A. Levine

11:00 a.m. – 12:00 p.m. ..... **Poster Session 1**
Alma Mater Room, iHotel & Illinois Conference Center
Topics: Sensory Nutrition
Dietary Bioactive Compounds I
Nutritional Epidemiology

***12:00 p.m. – 12:55 p.m.** ..... **Sponsor Network Lunch**
Heritage Hall 3, iHotel & Illinois Conference Center

†1:00 p.m. - 2:00 p.m. ..... **Oral Session 2: Animal Nutrition**
Heritage Hall 6, iHotel & Illinois Conference Center
1:00 - 1:15: Breanna Metras
1:15 - 1:30: Minoy Cristobal
1:30 - 1:45: Vanessa de la Guardia-Hidrogo
1:45 - 2:00: Meredith Smola

†2:00 p.m. – 3:00 p.m. ..... **Keynote Address: Diet and Cardiovascular Health: Epidemiology, Equity, and Enacting Change**
Cheryl Anderson, PhD, MPH, MS, UC San Diego
Heritage Hall 6, iHotel & Illinois Conference Center

3:00 p.m. – 4:00 p.m. ..... **Networking Event**
Heritage Hall 6, iHotel & Illinois Conference Center

4:00 p.m. – 5:30 p.m. ..... **Poster Session 2**
Alma Mater Room, iHotel & Illinois Conference Center
Evening Reception; Award Announcements
Topics: Dietary Patterns
Dietary Bioactive Compounds II
Food Science & Microbial Metabolism

* In-person attendance requires registration
† Streamed session for virtual attendees

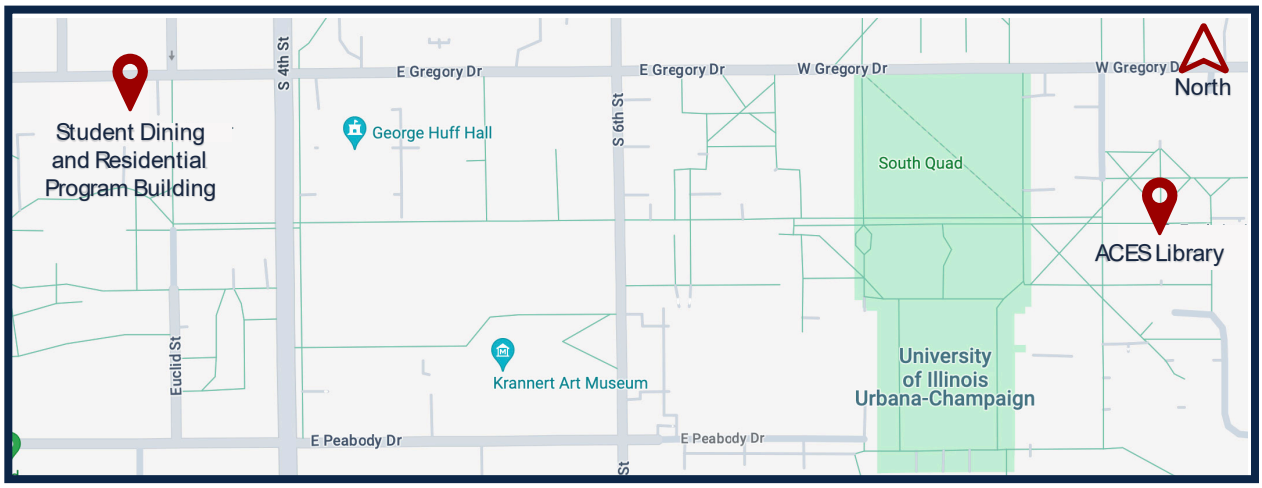
Symposium Maps

Student Dining and Residential Program Building

301 E. Gregory Drive, Champaign, IL 61820

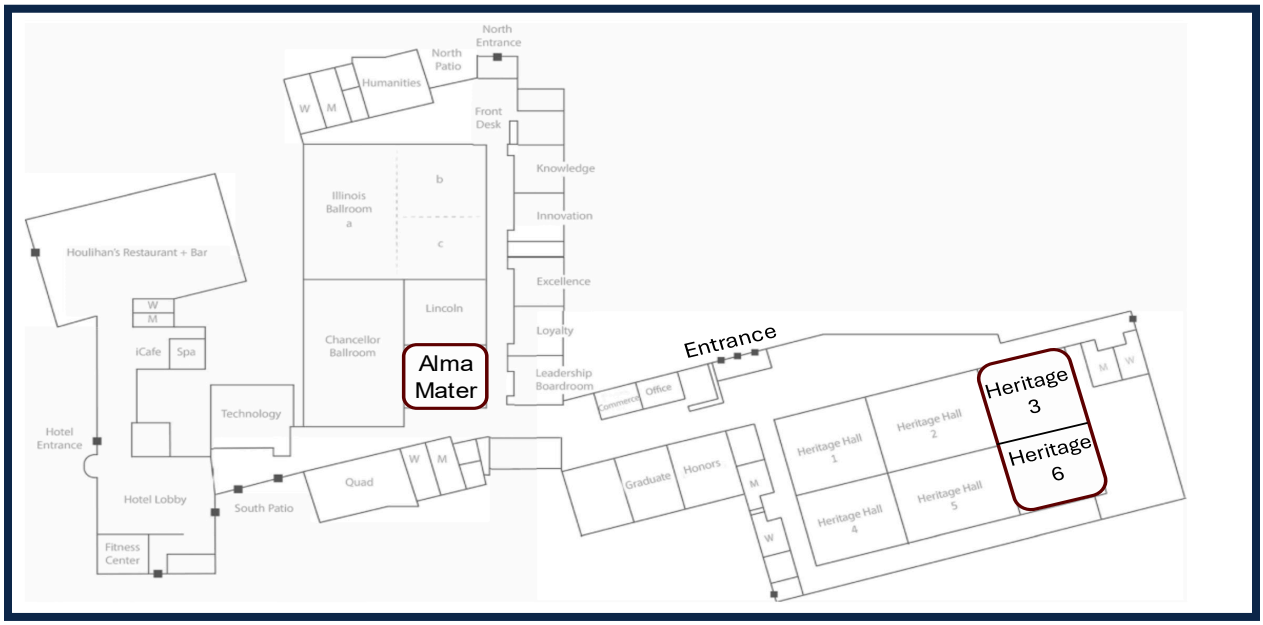
ACES Library

1101 S Goodwin Ave, Urbana, IL 61801



iHotel and Illinois Conference Center

111 St. Mary Road, Champaign, IL 61820



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Nutrition Symposium Chair

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Nutrition Symposium Chair-Elect

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Ayça N. Mogol
Stephanie Okoye
Kassandra Sandoval
Mara Perez Tamayo
Ximena Yrigoyen

Session Judges

Dr. Elisa Caetano
Dr. Hong Chen
Dr. Diego Hernandez-Saavedra
Dr. Christopher Kinder
Dr. Brett Loman
Dr. Michael Robben
Dr. Sandra Rodriguez Zas
Dr. Margarita Teran
Dr. Weinan Zhou

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https://nutrsci.illinois.edu/students/gsa

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ILLINOIS
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Faculty Mini-Symposium:
"From Seed to Pearls: Celebrating 30 years of Nutrition Science at UIUC"

Friday, April 12th, *2:55 p.m. - 4:55 p.m.*
2025A, Student Dining and Residential Program Building

Graduate Student Oral Session 1: Cancer, the Gut-Brain Axis, and Sensory Nutrition

Saturday, April 13th, 10:00 a.m. - 11:00 a.m.
Heritage Hall 6, iHotel & Illinois Conference Center

Graduate Student Poster Session 1

Saturday, April 13th, 11:00 a.m. - 12:00 p.m.
Alma Mater Room, iHotel & Illinois Conference Center
See poster session floor plan map on page 44

Sensory Nutrition

Dietary Bioactive Compounds I

Nutritional Epidemiology

Graduate Student Oral Session 2: Animal Nutrition

Saturday, April 13th, 1:00 p.m. - 2:00 p.m.
Heritage Hall 6, iHotel & Illinois Conference Center

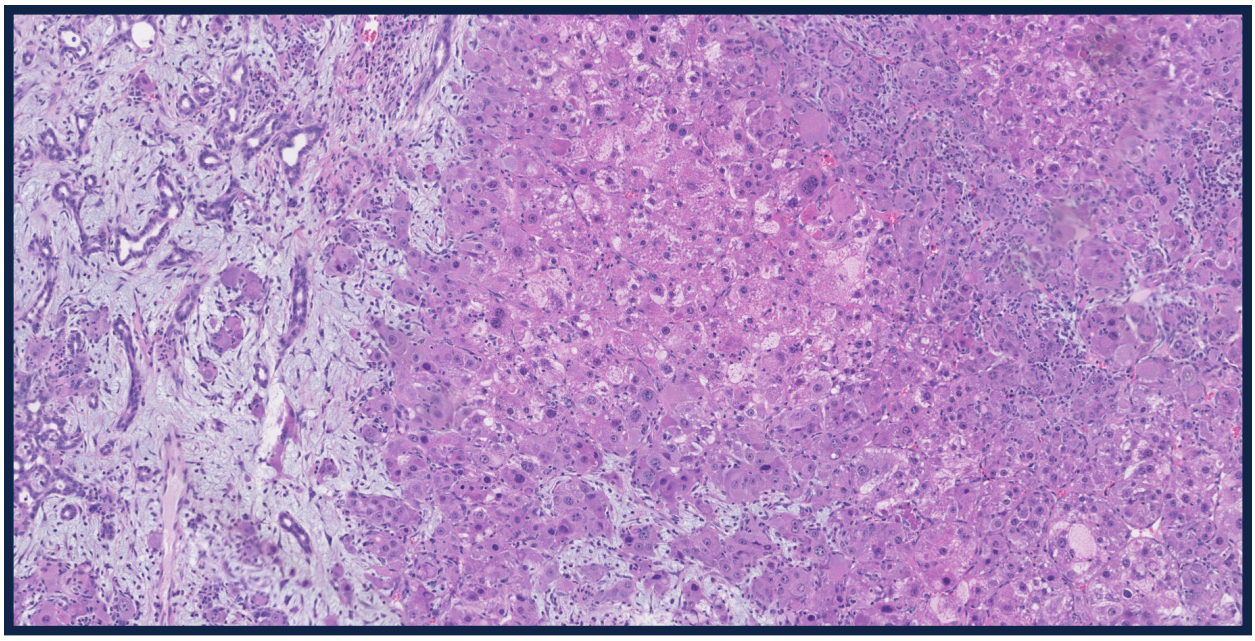
Graduate Student Poster Session 2

Saturday, April 13th, 4:00 p.m. - 5:30 p.m.
Heritage Hall 3, iHotel & Illinois Conference Center
See poster session floor plan map on page 44

Dietary Patterns

Dietary Bioactive Compounds II

Food Science and Microbial Metabolism



Staining of liver tumors in a mouse model of dysregulated bile acid metabolism.

Research image by Angela Dean

The University of Illinois Division of Nutritional Sciences and the Nutritional Sciences Graduate Student Association would like to acknowledge the generosity of the sponsors and friends of our 2024 Nutrition Symposium.

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Nlumn

Keynote Speaker

Cheryl A.M. Anderson, PhD, MPH, MS

University of California, San Diego

Professor and Dean, Herbert Wertheim School of Public Health and Human Longevity Science

Hood Family Endowed Dean's Chair in Public Health

Diet and Cardiovascular Health: Epidemiology, Equity, and Enacting Change

Dr. Cheryl A. M. Anderson is a Professor and Dean of the University of California San Diego Herbert Wertheim School of Public Health and Human Longevity Science. Dr. Anderson's research focuses on nutrition and chronic disease prevention in underserved populations using observational epidemiologic study designs, randomized clinical trials, and implementation science. Her research projects include the California Teachers Study; studies of stable carbon isotopes as novel dietary biomarkers for sweetened foods; clinical trials addressing lifestyle and behavioral factors for obesity reduction; and the RESOLVE to save 100 million lives D&I initiative. Her body of work addresses the effects of dietary patterns, sodium, and potassium intake on blood pressure and cardiovascular diseases; behavioral interventions for adherence to dietary recommendations; and identification of nutritional risk factors and for progression of kidney disease and development of cardiovascular events in individuals with chronic kidney disease. Dr. Anderson is the Director of the UC San Diego Center of Excellence in Health Promotion and Equity. She was a member of the 2015 US Dietary Guidelines Advisory Committee, and served on the National Academy of Medicine's Food and Nutrition Board. She is the current Chair of the American Heart Association's Epidemiology and Prevention Council and immediate past chair of the Nutrition Committee. She was elected to the National Academy of Medicine in 2016.

Keynote Address
2:00 p.m. – 3:00 p.m

Faculty Mini-Symposium:

From Seed to Pearls: Celebrating 30 years of Nutrition Science Research at UIUC

Abstracts and Biographies

Towards improved amino acid nutrition in humans

Dr. Hans H. Stein

Department of Animal Sciences, Division of Nutritional Sciences, University of Illinois Urbana-Champaign, Urbana, IL

ABSTRACT: The human requirements for amino acids are not well understood and is often referred to as a requirement for "protein". This is unfortunate because the protein requirement can be met without meeting the requirement for individual amino acids, which is especially true when plant proteins are used instead of animal proteins. At present, it is recommended that the digestible indispensable amino acid score (DIAAS) for each food is used in the formulation of meals for humans. Use of DIAAS is a major improvement over using previous systems and DIAAS has been determined for many food proteins. Values for DIAAS are also additive in mixed meals, which makes it possible to calculate the amino acid quality of a mixed meal. However, current and future work will make it possible to formulate meals based on specific requirements for digestible quantities of each indispensable amino acid, which will improve amino acid nutrition.

BIOGRAPHY: Dr. Hans H. Stein is a Professor of Nutrition in the Division of Nutritional Sciences and the Department of Animal Sciences at the University of Illinois, USA, where he has responsibilities in research, Extension, and teaching. His team consists of Graduate students, post-doctoral Research Fellows, research technicians, and visiting scholars. His research focuses on feed ingredient evaluation, digestibility and utilization of energy and nutrients by pigs and humans, and development of systems for accurate diet formulation. Dr. Stein has mentored more than 100 Graduate students, Post-doctoral research fellows, interns, and visiting scientists. He has authored or co-authored approximately 360 peer-reviewed publications and he has given invited presentations on nutrition in 41 countries.

Unraveling alcohol metabolism: A tale from female rats, to lactating women, to women who underwent metabolic surgery

Dr. M. Yanina Pepino

Department of Food Science and Human Nutrition, Division of Nutritional Sciences, University of Illinois Urbana-Champaign, Urbana, IL

ABSTRACT: Alcohol is the most widely used psychoactive drug in the world, and excessive drinking is the leading cause of premature death among people aged 15-49 years. Understanding the fate of alcohol after its oral consumption (i.e., alcohol pharmacokinetics) is the first step to estimating brain exposure and, in turn, predicting the behavioral and toxic effects of alcohol. Therefore, I have a long-standing interest in studying individual differences in alcohol's pharmacokinetics and its subjective effects. For over a decade, one of the focuses of research in my laboratory has been to determine mechanism(s) underlying the increased risk for alcohol misuse in women who undergo metabolic surgery. Naturally, the first mechanism we investigated was related to changes in alcohol pharmacokinetics. We found that metabolic surgeries, like sleeve gastrectomy and Roux-en-Y gastric bypass, accelerate alcohol absorption and heighten peak blood alcohol concentrations (BAC). Despite differences in how these surgeries re-arrange the anatomy of the gastrointestinal (GI) tract, they both reduce the stomach size and thus similarly decrease the fraction of alcohol metabolized in the stomach before reaching the bloodstream. Overall, our findings suggest that metabolic surgeries can lead to light-moderate drinking, resulting in BACs typically associated with binge drinking in individuals without surgery. This pattern of drinking is linked to increased health risk, the development of alcohol tolerance, and an elevated AUD risk. Science inquiry is rarely linear. Some of the questions I explored as a graduate student almost 25 years ago, particularly regarding the development of metabolic tolerance to alcohol in female rats, have found answers in recent assessments of alcohol metabolism in women with a history of metabolic surgery. By unraveling these mechanisms, we strive to advance our understanding of alcohol pharmacokinetics and improve clinical strategies to manage alcohol-related risks in individuals undergoing metabolic surgery, as well as in the general population.

BIOGRAPHY: Dr. Pepino is currently an Associate Professor of Ingestive Behavior at the Department of Food Science and Human Nutrition and at the Division of Nutritional Sciences at the College of ACES at the University of Illinois at Urbana Champaign and at Carle Illinois College of Medicine. She received a doctoral degree in chemistry from the Faculty of Chemical Sciences, National University of Córdoba, Argentina. After completing her graduate degree, she was a post-doctoral research fellow at Monell Center in Philadelphia. Before joining the University of Illinois, she was an Assistant Professor at the Center for Human Nutrition, Washington University School of Medicine in St. Louis. Her research interest centers mainly on two areas: 1) understanding the pharmacokinetic and pharmacodynamics effects of alcohol in humans; and 2) understanding how individual differences in flavor perception and nutrient metabolism shape dietary choices and, in turn, affect human health. By using a combination of psychometrically sound validated sensory assessment methods, and metabolic research methods, her laboratory is currently studying the effects of bariatric surgery on ingestive behavior and alcohol metabolism, and the role of sweet taste signaling on glucose homeostasis, and taste and smell dysfunction in clinical populations. Her research is funded by the National Institute of Health and by the American Diabetes Association.

Nutritional Sciences at UIUC – Embarking on Year 50

Dr. John W. Erdman Jr.

Department of Food Science and Human Nutrition, Division of Nutritional Sciences, University of Illinois Urbana-Champaign, Urbana, IL

ABSTRACT: April 1 this year marked the anniversary of my arrival to the University of Illinois as a much younger, Assistant Professor. As I move into my 50th year on campus as Emeritus Faculty in Food Science and Human Nutrition, there are many reflections, thoughts and memories. The Division of Nutritional Sciences was only in its 7th year and many of the research tools available today to faculty and students were not yet developed. Research costs and administrative burden were small but research productivity required the same creativity, drive and focus as today. Professor Donovan and I have written a manuscript reviewing over 100 years of nutrition research and teaching at the University of Illinois. Highlighted were research themes from more than a half century ago and those in more recent years. The interdisciplinary nature of nutrition research then and now is one of the most special attributes of this campus. Part of my presentation will be devoted to some of the past nutrition highlights and contributions from UIUC. Additionaly, reflections from my labortory's research program, the success of numerous research collaborations, as well as recommendations to young researchers in nutritional science will be provided.

BIOGRAPHY: Dr. Erdman is Emeritus Professor of Food Science and Human Nutrition at the University of Illinois at Urbana Champaign. He recently served as Deputy Director of the Interdisciplinary Health Sciences Institute on the Illinois campus. He has an active research program focused upon health aspects of carotenoids and vitamin E. He has authored over 240 original research articles and over 400 total publications (h-index is 67). He is a Fellow of the American Society for Nutrition (ASN), the Institute of Food Technologists (IFT) and the American Heart Association (AHA). He is past President of the American Society for Nutritional Sciences (now ASN). He has served on over two dozen committees for the Institute of Medicine, National Academy of Sciences (NAS). He is currently chair of the Standing Committee for the Review of the Dietary Reference Intakes Framework and past chair of the Committee on Military Nutrition Research for NAS. He was elected as a Member of the Institute of Medicine (now National Academy of Medicine). He has received numerous honors for research, teaching, and mentoring. His B.S., M.S., M.Phil. and Ph.D. are in Food Science from Rutgers University.

Graduate Student Oral Session Abstracts

Oral Session 1: Cancer, the Gut-Brain Axis, and Sensory Nutrition

A murine model of sex-dependent hepatocellular carcinoma exhibits in bile acid composition and dysbiosis

Angela E. Dean[1,2], C. A. Gaulke[2,3], S. Anakk[1,2,4]

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[4] Molecular and Integrative Physiology, University of Illinois Urbana-Champaign, Urbana, IL

INTRODUCTION: Hepatocellular carcinoma (HCC) is one of the leading causes of cancer-related deaths, and men have a higher incidence and mortality than women. If caught early, HCC has a high curative rate. However, the current surveillance methods fall short. Increased bile acid concentrations have been noted in HCC.

Primary bile acids, cholic acid (CA) and chenodeoxycholic acid (CDCA), are made in the liver and conjugated to either taurine or glycine. To aid in fat digestion, bile acids are secreted into the intestine and can interact with resident microbes, which remove the amino acid residue and modify them into secondary bile acids, deoxycholic acid (DCA) and lithocholic acid (LCA). From the intestine, bile acids are reabsorbed and circulated back to the liver. If the bile acids cannot enter the liver or spill out due to defective transport, their systemic levels increase in circulation. In fact, such increases in serum BA are noted during HCC. Here we investigated if changes in bile acid in HCC influence the microbial composition. Therefore, we assessed the associations between tumor markers and bile acid and microbial composition.

METHODS: We aged a double knockout (DKO) mouse model for bile acid-related nuclear receptors, farnesoid X receptor (*Fxr*) and small heterodimer partner (*Shp*), to one year as they developed spontaneous HCC and mimic sex differences seen in the clinical setting. We collected serum, liver, cecal, and fecal samples from each mouse to examine bile acid composition, liver gene expression, and fecal microbial composition.

RESULTS: We find that the DKO male mice have increased circulating bile acids compared to female DKOs. We observed a higher proportion of unconjugated CA in the serum and a reduction in unconjugated DCA. Increases in unconjugated CA does not stem from lack of conjugation liver as the hepatic gene that encodes the conjugating enzyme is not altered. Instead, we found differences in fecal microbial diversity and increased counts of *Bifidobacterium* and *Faecalibaculum*, both of which are known for bile acid deconjugation, in the DKO model. We further found that reduced expression of HCC tumor marker genes along with a reduced proportion of unconjugated DCA positively correlates to increased *Bifidobacterium* and *Faecalibaculum*.

CONCLUSION: These findings demonstrate that dysregulated bile acid metabolism occurs in a sex specific manner in HCC and that this coincides with microbial dysbiosis. Thus, serum bile acid composition along with fecal microbiome could be leveraged for detection and for measuring therapeutic efficacy in HCC.

Taste and smell perception after metabolic surgery

Jessica G. Nicanor-Carreón[1], B. Rowitz[1,2,3], M.Y. Pepino[1,4]

[1] Division of Nutritional Sciences, University of Illinois Urbana-Champaign, Urbana, IL
[2] Carle Illinois College of Medicine, Urbana, IL
[3] Department of Surgery, Carle Foundation Hospital, Urbana, IL
[4] Food Science and Human Nutrition, University of Illinois Urbana-Champaign, Urbana, IL

INTRODUCTION: Most patients report "taste" changes after undergoing weight loss surgeries. However, when we evaluated patients using validated sensory evaluation techniques, we found no changes in perceived taste intensity or sensitivity pre- to post-surgery. Because we assessed participants with pure gustatory stimuli in a fasting state, it is unclear if patients' self-reported "taste" changes are due to retronasal smell/ "flavor" changes or are only manifested during the fed state.

METHODS: Using a cross-sectional study design, we compared sensory responses in women who underwent metabolic surgery 2-6 years ago (n=15) with a non-operated-Body Mass Index (BMI) equivalent group (n=15) and a normal BMI group (n=15) over two visits: one fed and one fasted. Using a sip-and-spit method, women tasted solutions representative of basic taste qualities containing matching odorants (e.g., sucrose with strawberry extract) with and without nose clips. They used separate general labeled magnitude scales to rate their perceived intensity of taste, smell, flavor, and pleasantness.

RESULTS: Results from mixed ANOVAs show that the surgery group rated smell intensity as stronger than the normal BMI group for all stimuli ($p \leq 0.05$); values in the non-operated-BMI equivalent group were intermediate between the other groups. However, all groups rated taste as equally intense and pleasant and displayed similar enhanced taste intensity when tasting samples without vs. with nose clips ($p < 0.001$). Feeding conditions failed to affect intensity ratings.

CONCLUSION: Our findings suggest that metabolic surgery is associated with perceiving a stronger intensity of retronasal smell without impact on taste perception and that feeding condition is unimportant for assessing taste or smell intensity perception in women.

Do nutrition interventions improve gastrointestinal symptoms during cancer treatment? A systematic review and meta-analysis

Zainab Alzoubi[1], B. Loman[1,2]

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[2] Department of Animal Sciences, University of Illinois Urbana-Champaign, Urbana, IL

INTRODUCTION: Cancer therapy is associated with numerous gastrointestinal (GI) symptoms. The most common symptoms: nausea, diarrhea, vomiting, constipation, and mucositis can be dose-limiting, potentially leading to treatment failure, and reduce overall patient quality of life. Preventing weight loss and malnutrition are common targets of medical nutrition therapy in these patients, but less attention has been given to their ability to reduce GI symptoms. Therefore, the objective of this study was to assess the ability of medical nutrition to reduce GI side-effects of cancer treatment via systematic review and meta-analysis of the available literature.

METHODS: A systematic keyword search was conducted in Scopus and PubMed databases. The search algorithm included all possible combinations of terms from the following 3 groups: (1) GI Symptoms; (2) Cancer Treatment; and (3) Nutrition. Potentially relevant articles were screened by title and abstract, then full text against the study inclusion criteria. A meta-analysis was performed on articles meeting inclusion criteria to estimate the pooled effect size on GI symptoms, assessed by incidence and severity report depending on the sub-category of nutrition intervention (Oral Intake, Oral Nutrition Supplement (ONS), or Dietary Counseling). Subgroup analyses were further conducted based on cancer type, cancer therapy, and specific nutrient intervention. All statistical analyses were performed in Stata using 2-sided tests with $p < 0.05$ as the threshold for statistical significance.

RESULTS: 16,013 articles were captured by the search algorithm, and 150 studies met inclusion criteria for meta-analysis. Articles reported 13 different GI symptoms, resulting in 152 total meta-analyses by symptom, cancer treatment, and nutrition intervention subtype. Meta-analyses indicated that collectively (all interventions combined), oral intake reduced nausea, vomiting, and diarrhea incidence ($p < 0.001$). Probiotic supplementation had one of the strongest effect on reducing diarrhea incidence during chemotherapy ($p < 0.001$). ONS had no effects on GI symptoms (all $p > 0.05$). Dietary counseling reduced diarrhea incidence ($p = 0.01$).

CONCLUSION: This meta-analysis supports the use of specific nutrition therapies in treatment of cancer therapy induced GI symptoms and identifies those that require additional investigation. Future studies should explore personalized nutrition strategies to combat these symptoms.

Prebiotic dietary fiber consumption confers resilience to psychological stress

Benjamin A. Levine[1], J.E. Rindels[1], Z. Alzoubi[1], D. Ugalde[2], B.R. Loman[1,2]

[1] Division of Nutritional Sciences, University of Illinois Urbana-Champaign, IL, Urbana, IL
[2] Department of Animal Sciences, University of Illinois Urbana-Champaign, IL, Urbana, IL

INTRODUCTION: Irritable bowel syndrome (IBS) is a common yet poorly understood condition characterized by chronic and severe intestinal dysmotility. Psychological stress is an environmental exposure that enhances the frequency and intensity of dysmotility and reduces the abundance of microbial genera that confer stress resilience. In contrast, prebiotic-rich diets reliably enhance the relative abundance of microbial genera that confer resilience to stress and improve intestinal transit. Therefore, the *objective* of this proposal is to establish how psychological stress and prebiotic dietary fiber consumption interact and shape the stress response and intestinal motility. Our *central hypothesis* is that prebiotic consumption will improve stress reactivity and attenuate stress-induced intestinal dysmotility.

METHODS: Male and female C57BL/6 mice (age 6-8 weeks, n=6, N=96) were randomized into sixteen groups with factors of sex (male/female), two weeks of diet (1. Fiber-free diet [FFD] (base diet), 2. FFD + 20% cellulose [CELL] [non-prebiotic fiber control], 3. FFD + 10% cellulose + 10% short-chain fructooligosaccharide [scFOS] [short-chain prebiotic fiber], or 4. FFD + 10% cellulose + 10% inulin [INU] [long-chain prebiotic fiber]), and two hours of daily restraint stress exposure during the second week on diet (stressed [S] vs non-stressed [NS]). On day one of restraint, blood was collected at 0, 30, 60, 90, 120 min, and one hour post-stress (180 min) for quantification of corticosterone via ELISA. Adrenal mass (a marker of stress responsivity) was measured as a percentage of total body mass. Intestinal motility was measured ex-vivo via an organ bath and force transducer system and LabChart analysis software. Corticosterone and adrenal data were tested via three-way ANOVA (sex, stress, and diet factors) with post-hoc LSD.

RESULTS: Females had higher adrenal mass vs males ($p<0.00001$). Female S-INU had lower adrenal gland mass vs S-FFD and S-CELL (all $p<0.05$). Male S tended to have higher adrenal mass ($p=0.1$), and Male FFD had higher adrenal mass vs INU ($p=0.01$). With S, corticosterone increased across time ($p<0.00001$) with a diet-by-time interaction ($p<0.001$). At 120 min, S-CELL, S-scFOS, and S-INU had lower corticosterone vs S-FFD (all $p<0.05$). Total corticosterone response to S was lower in CELL ($p=0.01$) and scFOS ($p=0.007$), but not INU ($p=0.35$), relative to FFD. Stimulated ileal contractile force was higher in S-FFD and S-scFOS vs NS-FFD and NS-scFOS (all $p < 0.05$).

CONCLUSION: Overall, these data indicate that prebiotic dietary fiber consumption confers resilience to stress-induced glucocorticoid secretion and intestinal dysmotility. Ongoing studies are investigating whether these data are correlated with shifts in gut microbiome and enteric nervous system structure.

Oral Session 2: Animal Nutrition

In vitro fermentation characteristics of dietary fibers using starter bacterial culture, grain kefir culture, or canine feces as inoculum

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INTRODUCTION: Traditional grain kefir is produced from the fermentation of milk with yeast- and bacteria-containing cultures. To maintain consistency and adhere to food safety guidelines, industrial producers sell kefir products based on starter bacterial cultures (typically no yeast). Bacterial profiles of starter vs. grain kefirs differ, but their influence on health effects are unknown. The objectives of this experiment were to determine the *in vitro* fermentation characteristics of common dietary fibers using 1) a starter bacterial culture or a grain kefir culture as inoculum and 2) fecal inoculum from dogs supplemented with starter- or grain-based kefirs.

METHODS: Twelve adult beagle dogs were given one of 3 treatments (n=4/group; 60 mL/d): 2% reduced-fat milk treated with lactase (control); starter kefir (S-Kefir; Champions Choice); or grain kefir (G-Kefir; Kefir Garden Grains). After 14 d, fresh fecal samples were collected and immediately frozen in a 20% glycerol solution. Fecal samples were thawed for the *in vitro* experiment, heated to 39°C, pooled by treatment, and diluted 1:4 (wt/vol) in anaerobic diluting solution under CO_2. Blended, diluted feces was then used to inoculate tubes containing semi-defined medium and one fiber source: cellulose (CEL, negative control), pectin (PEC, positive control), beet pulp (BP), or chicory pulp (CP). Fibrous substrate triplicates were incubated at 39°C for 0, 6, 12, or 18 h. Incubation was stopped at each interval and processed for measurement of pH, short-chain fatty acid (SCFA) concentrations, and microbiota populations using 16S rRNA gene amplicon sequencing. A second *in vitro* experiment was conducted using similar methods and measurements, but by using S-Kefir and G-Kefir as inoculum sources. Main and interactive effects of treatment and time within fiber source were tested using SAS, with significance considered $P<0.05$.

RESULTS: Using fecal inoculum, BP and PEC were rapidly fermented, leading to large pH reductions, SCFA increases, and microbiota shifts. pH change was of greater ($P<0.05$) magnitude (PEC) and higher ($P<0.05$) kinetic rate (CP) when using feces from dogs fed S-Kefir or G-Kefir than controls. Butyrate increases were greater ($P<0.05$) in tubes inoculated with G-Kefir feces than S-Kefir or control feces. When PEC and BP were fermented, tubes with S-Kefir feces had greater ($P<0.05$) acetate, propionate, and total SCFA increases than G-Kefir or control feces. Fermentations were slower using starter and kefir cultures, but some differences were noted. Butyrate was higher ($P<0.05$) in CEL and CP tubes fermented by S-Kefir, but higher ($P<0.05$) in PEC and BP tubes fermented by G-Kefir. Bacterial beta diversity and relative abundances shifted over time within each substrate and were unique to inoculum source.

CONCLUSION: These data suggest that the activity of kefir bacterial populations differ and that kefir consumption changes the abundance and activity of the fecal microbiota of dogs, justifying *in vivo* investigation.

Effect of feeding intact protein from soybean meal instead of crystalline amino acids on growth performance, protein synthesis, and immune response of growing pigs

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INTRODUCTION: Reducing soybean meal (SBM) and increasing crystalline amino acids (AA) in pig diets may impact daily nitrogen retention, suggesting AA deficiency or essential factors in SBM other than AA. Pigs are thought to genetically deposit protein, potentially leading to fat deposition under AA deficiency. It is assumed that protein synthesis rates are constant, regardless of AA source, but no research has validated this assumption. The objective was to test the hypothesis that feeding intact protein from SBM instead of crystalline AA does not affect growth performance, protein synthesis, intestinal morphology, or immune response of growing pigs.

METHODS: A control corn-SBM diet was used. Three additional diets were formulated by reducing the inclusion rate of SBM and adding 3, 4, or 5 crystalline AA (i.e., Lys, Met, Thr, Trp, Val) to the diets, which resulted in reducing the protein concentration from 20.0% to 13.4%. All diets were formulated to meet requirements for standardized ileal digestible indispensable AA. A total of 176 pigs (initial weight = 32.2 kg; SD = 4.2) were used. On d 1, 16 randomly chosen pigs were euthanized and body nutrient composition was determined. The remaining 160 pigs were allotted to the 4 diets using a randomized complete block design with 4 pigs per pen and 10 replicate pens per diet. Starting weight was the blocking factor. Individual pig weights and feed consumption were recorded. On d 28, one pig per pen was slaughtered and blood, carcass, and viscera were collected and analyzed for N, fat, and energy to calculate deposition in the body. Ileal mucosa, ileum and colon tissue and digesta were analyzed for blood characteristics, cytokines, tissue morphology, ammonia, and gene expression. Contrasts coefficients were used to determine linear and quadratic effects of reducing dietary protein.

RESULTS: Results indicated that average daily gain, average daily feed intake, gain to feed ratio, carcass characteristics, and protein, lipid, and energy depositions were not affected by reducing SBM and increasing crystalline AA in diets (Table 1). However, energy efficiency tended to decrease (quadratic, $P = 0.083$) by reducing dietary protein. Blood urea N was reduced (linear, $P < 0.001$) as dietary protein was reduced, but blood total protein was not affected by dietary treatment. Cytokines, ileal and jejunal morphologies, and gene abundance of AA transporters in the ileal mucosa were not affected by dietary protein. Ammonia concentrations in ileal digesta increased and then decreased (quadratic, $P = 0.043$) and colon digesta tended to increase and then decrease (quadratic, $P = 0.074$) as dietary protein was reduced. Bacteria protein in colon digesta was reduced (linear, $P = 0.030$) by reducing dietary protein.

CONCLUSION: In conclusion, providing AA from intact protein from SBM or from crystalline AA did not affect growth performance, intestinal morphology, and immune response of pigs. However, SBM in diets can provide energy that may be utilized more efficiently than energy from diets with less SBM and crystalline AA. Further research is suggested to elucidate if SBM improves utilization of other nutrients in diets for pigs.

In vitro fermentation characteristics of dietary fibers using fecal inoculum from dogs consuming a dried brewer's yeast product

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INTRODUCTION: The increasing demand for functional ingredients in pet foods has focused attention on yeast-based ingredients. Previous studies have shown that these ingredients can modulate gut microbial composition. However, limited information is available regarding its effects on gut fermentation processes.

METHODS: This study used an in vitro fermentation assay to evaluate the effects of yeast supplementation on the fecal microbiota activity of dogs. Sixteen adult dogs (BW: 9.0 ± 1.7 kg) were acclimated for 7 d and then randomly assigned to a control diet (no yeast) or a treatment diet (1.5% dried brewer's yeast) for 21 d. After 21 d, fresh fecal samples were collected and used as inoculum for the in vitro fermentation of dietary fibers commonly used in pet foods [beet pulp (BP), pectin (PEC), and cellulose (CEL)]. After 0, 6, 12, or 18 h of fermentation, pH, short-chain fatty acid (SCFA) concentrations, and microbiota populations were measured. Blank-corrected data were analyzed using the PROC MIXED procedure of SAS (SAS Institute Inc., version 9.4, Cary, NC). Significance was declared at $p \leq 0.05$ and trends at $p \leq 0.10$.

RESULTS: Distinct fermentation patterns were observed among fiber substrates, with PEC having the highest fermentation, BP being moderately fermented, and CEL having a low fermentability. Bacterial beta-diversity analysis showed that the bacterial community at 0 h differed ($p<0.01$) from that at 6, 12 or 18 h. Beta-diversity was also different ($p<0.01$) among fiber sources, with CEL and blank tubes being different from PEC and BP tubes. Within fiber sources, bacterial communities are separated into distinct clusters by inoculum source over time. Within BP and PEC samples, tubes inoculated with feces of dogs fed yeast had a slower and more moderate decrease in pH than those inoculated with control dog feces ($p<0.01$). Total SCFA and acetate tended to be higher ($p<0.10$) in BP control tubes than BP yeast tubes. BP yeast tubes had greater increases ($p<0.05$) in Catenibacterium and Faecalibacterium and greater decreases ($p<0.05$) in Fusobacterium and Sutterella than BP control tubes. In PEC tubes, increases in butyrate were greater ($p = 0.03$) in tubes inoculated with feces from control dogs than feces from dogs fed yeast. PEC tubes inoculated with feces from dogs fed yeast had a greater increase ($p<0.01$) in Catenibacterium and a greater decrease ($p<0.01$) in Fusobacterium than tubes inoculated with control dog feces. PEC tubes inoculated with control dog feces had greater increases ($p<0.01$) in Bacteroides, Holdemanella, and Streptococcus and greater decreases ($p<0.01$) in Collinsella, Blautia, Lactobacillus, and Peptoclostridium than tubes inoculated with feces from dogs fed yeast.

CONCLUSION: This study suggests that dried brewer's yeast influences the canine gastrointestinal microbial composition and fermentation patterns in vitro, justifying in vivo studies.

Amino acid digestibility and protein quality of fermented soybean-based ingredients using the precision-fed cecectomized rooster assay

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INTRODUCTION: Fermented soybean-based ingredients may serve as an alternative protein source for pet foods because of their high-quality protein content. The amino acid (AA) content and protein quality of fermented soybean-based ingredients may vary depending on their composition and processing, however, so testing is required. Our objective was to measure the AA composition, AA digestibility, and protein quality of fermented soybean-based ingredients using the precision-fed cecectomized rooster assay.

METHODS: The University of Illinois Institutional Animal Care and Use Committee approved all animal procedures prior to experimentation. Thirty cecectomized roosters (n=6/substrate) were randomly allotted to one of five test substrates: 1) autoclaved soybean (ASB); 2) fermented soybeans (FSB); 3) fermented soybeans with probiotics (FSBP); 4) fermented soybean meal (FSBM); 5) fermented soybean meal with probiotics (FSBMP). After 26 h of feed withdrawal, roosters were tube-fed test substrates. Following crop intubation excreta samples were collected 48 h. Endogenous loss corrections for AA were made by using five additional cecectomized roosters. All data were analyzed using SAS version 9.4.

RESULTS: All substrates had high AA digestibilities, with all indispensable AA digestibilities being >80% except for lysine (78.1%-86.9%). Tryptophan digestibility was lower ($P<0.05$) in FSB than other substrates, but other AA digestibilities were not different. Digestible indispensable AA score (DIAAS)-like values were calculated to determine protein quality according to nutritional guidelines for adult dogs, adult cats, growing puppies, and growing kittens. The limiting AA was the same for all ingredients. In adult dogs, methionine was the limiting AA based on National Research Council (NRC; DIAAS: 33.4-35.1), European Pet Food Industry Nutritional Guidelines (FEDIAF; DIAAS: 49.6-52.1), and Association of American Feed Control Officials (AAFCO; DIAAS: 60.2-63.2) guidelines. In adult cats, phenylalanine was the limiting AA (DIAAS: 59.5-63.2) when using NRC guidelines, but DIAAS were above 100 for FEDIAF and AAFCO guidelines. In growing puppies, methionine was limiting according to NRC (DIAAS: 56.7-59.6) and FEDIAF (DIAAS: 78.8-82.7) guidelines, but threonine was limiting according to AAFCO (DIAAS: 68.8-72.3) guidelines. In growing kittens, methionine was limiting according to NRC (DIAAS: 70.9-74.4) and AAFCO (53.4-56.0) guidelines, but phenylalanine was limiting according to FEDIAF (DIAAS: 66.7-70.8) guidelines.

CONCLUSION: Our results demonstrate that fermented soybean-based ingredients are high-quality protein sources. Even though they are not complete proteins, these data suggest that they would serve as strong complementary proteins for use in pet foods. Further research in dogs and cats is necessary to confirm sufficient palatability and digestibility is justified.

Graduate Student Poster Session Abstracts

Poster Section: Sensory Nutrition

How sweet is it? Sex-related differences in sweetness perception of habitual and non-habitual consumers of low-calorie sweeteners

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INTRODUCTION: Roughly 50% of US adults turn to low-calorie sweeteners (LCS) to reduce sugar and calorie intake. Surprisingly, instead of replacing sugars, many end up adding LCS into their diets, leading to increased overall sweetness consumption. This study examines whether regular consumption of low-calorie sweeteners (LCS) dulls the perception of sweetness, potentially driving individuals to seek more sugar to attain the same desired level of sweetness. We hypothesized that habitual low-calorie sweetener consumers (HC) would exhibit increased adaptation to repetitive sweet taste stimulation compared to non-habitual consumers (NHC). Additionally, we investigated whether sweet adaptation patterns varied by sex.

METHODS: We conducted sensory tests on 40 HC (22 females/18 males) and 44 NHC (27 females/17 males), involving the tasting of sugar (glucose or fructose) and an LCS (sucralose) at different concentrations. HC consumed >5 and NHC <1 diet soda or LCS equivalent product per week. Sucralose solutions were presented alone or mixed with a small amount of sugar (111M glucose or 45M fructose) over 8 consecutive trials.

RESULTS: We found that consistent with previous findings, adaptation was more pronounced with sucralose alone compared to sucralose mixed with a small amount of sugar. However, there were no overall differences in the patterns of sweetness adaptation between HC and NHC, whether with sucralose alone or blended with sugars. Interestingly, a sex-by-LCS group interaction emerged, with female HC displaying greater adaptation and male HC showing less adaptation than their respective NHC counterparts.

CONCLUSIONS: These sex-related differences in sweetness adaptation depending on LCS consumption are intriguing and warrant further investigation to confirm their validity and explore potential underlying mechanisms.

How bitter is it? Odor-induced bitter taste modulation of bitter ligands

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INTRODUCTION: Recent computational methods and machine learning models predict that 14% of the known bitter compounds might also have a smell. The aim of this study is to better understand the impact of retronasal olfaction in the perception of bitter taste and chemesthetic irritation of known bitter compounds. To achieve this, we evaluate individuals' perceptions of bitterness and irritation in response to multiple suprathreshold concentrations of various pharmaceutical and food-grade ligands, both with and without the use of nose clips

METHODS: Employing a panel of well-trained healthy adults, we gathered taste, smell and irritation intensity ratings from 35 participants, all adept in utilizing the general labeled magnitude scale (gLMS). Participants followed a sip-and-spit protocol to sample nine different bitterants, randomly presented at three concentrations (including Naringin 10/50/100mM, Ibuprofen 10/44/100mM, Theobromine 1/10/30mM, Acesulfame K 1/12/100mM, Sodium Benzoate 50/100/300mM, Acetaminophen 1/10/100mM, Propylthiouracil 0.056/0.18/0.56 mM, Dextromethorphan 0.01/0.1/1mM, and Diphenhydramine 0.5/1/10 mM).

RESULTS: Our findings align with the predictions of computational models, indicating that most bitterants in our study lacked any discernible smell. Therefore, for most of the compounds, bitterness (and irritation) ratings remained consistent whether tasted with or without nose clips. However, the nose clip condition had a significant effect on the perception of ibuprofen and naringin. Particularly noteworthy is that the retronasal influence enhanced the bitterness (and irritation) of ibuprofen while inhibiting the bitterness of naringin.

CONCLUSION: These findings contribute to our understanding of the complex dynamics involved in the integration of taste and odor perception of bitter stimulants.

The bitter side of habitual low-calorie sweeteners (LCS) use: exploring associations with LCS consumption patterns and glucose metabolism, sweetness perception, and added sugar intake

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INTRODUCTION: Despite their popularity, low-calorie sweeteners (LCS) continue to raise health concerns, including their impact on glucose metabolism. This study investigates whether sweet taste signaling plays a role in postprandial glucose metabolism and whether habitual LCS consumption alters this role in people with obesity.

METHODS: Using a randomized crossover design that included 14 non-habitual (8 males/6 females) and 22 habitual (10 males/12 females) LCS consumers, none with diabetes, we assessed the metabolic responses to three oral glucose tolerance tests (OGTT): 1) a control OGTT, 2) an OGTT where sweetness was inhibited by the addition of lactisole, a human sweet taste receptor antagonist, and 3) an OGTT mixed with lactisole preceded by tasting and expectorating sucralose. We also assessed participants' daily consumption of total and added sugars using the Diet History Questionnaire III and their sweet taste sensitivity and preferences for glucose and sucralose using validated sensory tests.

RESULTS: In agreement with previous studies, we found sex-related differences in postprandial glucose responses, with males having higher glycemia than females, but this was observed in the non-habitual LCS group and absent in the habitual LCS group. Compared with the control OGTT, consuming glucose in the absence of its sweetness increased insulin secretion, but only in females. LCS consumption was linked to higher added sugar intake but not to differences in sweet taste sensitivity or preferences.

CONCLUSIONS: In conclusion, our findings suggest a role of sweet taste in insulin responses to glucose, particularly in females, and a potential influence of habitual LCS consumption on sex-related differences in postprandial glucose responses. These findings also support that LCS augment dietary sweetness rather than serving as sugar substitutes.

Poster Section: Dietary Bioactive Compounds I

Effects of xylanase or a stimbiotic on growth performance and total tract digestibility of nutrients by pigs weaned from sows fed a lactation diet without or with xylanase

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INTRODUCTION: Arabinoxylans are the predominant fiber component in cereal grains and cereal co-products. Xylanase hydrolyzes the beta-(1− 4) glycosidic bonds between xylose units in the backbone of arabinoxylans and releases xylo-oligosaccharides that can be fermented by pigs. Previous data indicate that xylanase increased the degradation of dietary fiber and increased energy digestibility in diets for growing pigs and lactating sows. Xylo-oligosaccharides improve growth performance of nursery pigs because they serve as prebiotics that modulate gut microbiota. A stimbiotic (i.e., xylanase in combination with xylo-oligosaccharides) may improve growth performance of weanling pigs to a greater extent than either additive alone by shifting the intestinal microbiome to favor fiber fermentation. However, there are no data on effects of xylanase in sows diets on growth performance of the offspring or on the impact of the stimbiotic on digestibility of nutrients when fed to nursery pigs. Therefore, two hypotheses were tested: 1) the offspring of sows fed xylanase in lactation have greater growth performance after weaning than offspring of sows fed no xylanase, and 2) xylanase and a stimbiotic (i.e., xylanase in combination with xylo-oligosaccharides) improve growth performance, apparent total tract digestibility (ATTD) of gross energy (GE) and total dietary fiber (TDF), and digestible energy (DE) of diets for weanling pigs.

METHODS: A total of 120 newly weaned pigs from sows fed a lactation diet without xylanase and 120 pigs from sows fed a lactation diet containing 16,000 beechwood xylanase units (BXU) per kg of an exogenous xylanase were used (initial body weight: 5.81 ± 0.50 kg). Pigs were allotted to a 2 × 3 factorial with two sow groups (lactation diet without or with xylanase) and three dietary treatments (i.e., control, control plus 100 g/t of xylanase, or control plus 100 g/t of stimbiotic). The xylanase (Econase XT) and the stimbiotic (Signis) were procured from AB Vista, Marlborough, UK. Pigs were weaned in 4 blocks and allotted to 12 pens per block, with 5 pigs per pen for a total of 8 replicate pens per treatment. Pigs were fed phase 1 diets from d 1 to 14, phase 2 diets from d 15 to 28, and phase 3 diets from d 29 to 42 post-weaning. Average daily gain (ADG), average daily feed intake (ADFI), and gain:feed (G:F) were calculated. Fecal samples were collected at the end of phases 2 and 3. Data were analyzed using the MIXED procedure of SAS. Sow group, diet, and the interaction between sow group and diet were fixed effects, and block and replicate within block were random effects.

RESULTS: For the overall experiment, there were no interactions between sow group and diet, and sow lactation diet treatment did not impact any post-weaning growth or digestibility parameters in the weaned pigs. However, weaned pigs had greater ($P < 0.05$) ADG, G:F, ATTD of GE and TDF, and DE in phase 2 if fed the diet with stimbiotic than if fed the xylanase diet or the control diet, but pigs fed the xylanase diet had greater ($P < 0.05$) ADG, G:F, ATTD of GE and TDF, and DE than pigs fed the control diet (Table 1). In phase 3, pigs fed the diet with xylanase or stimbiotic had greater ($P < 0.05$) ADG, ATTD of GE and TDF, and DE than pigs fed the control diet.

CONCLUSIONS: Pigs fed diets containing xylanase or stimbiotic had greater nutrient digestibility and DE, resulting in greater overall ADG, G:F, and final body weight on d 42 post-weaning, but feeding sows xylanase in lactation did not influence post-weaning growth performance.

Effect of feeding intact protein from soybean meal instead of crystalline amino acids on energy and nitrogen balance by growing pigs

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INTRODUCTION: Reducing soybean meal (SBM) and increasing crystalline amino acids (AA) in pig diets may impact daily nitrogen retention, suggesting AA deficiency or essential factors in SBM other than AA. It is believed that diets with less excess AA should have more energy available for the pig because less energy is used for deamination. Therefore, the objective was to test the hypothesis that feeding intact protein from soybean meal to growing pigs instead of crystalline amino acids increases nitrogen (N) retention, digestible energy (DE), and metabolizable energy (ME).

METHODS: A control corn-SBM diet and three diets, in which the inclusion rate of SBM was reduced and 3, 4, or 5 crystalline AA (i.e., Lys, Met, Thr, Trp, Val) were added, were formulated. The concentration of standardized ileal digestible AA was constant among diets, but crude protein was reduced as crystalline AA were added. Pigs were limit fed at 3.2 times the ME requirement for maintenance. Forty pigs (initial weight = 20.5 kg; SD = 2.4) were allotted to the 4 diets using a randomized complete block design with 2 blocks of 20 pigs with five pigs per diet in each block. Pigs were housed in metabolism crates with pans and screens that allowed for quantitative collection of feces and urine for 4 d after 5 d of adaptation. Samples of diets, feces, and urine were analyzed for gross energy (GE) and N. The statistical model included diet as fixed effect and block as random effect, and pig was the experimental unit. Contrasts coefficients were used to determine linear and quadratic effects of reducing dietary protein.

RESULTS: Results indicated that apparent total tract digestibility (ATTD) of dry matter (DM) decreased (quadratic, $P = 0.027$) and ATTD of GE tended to decrease (quadratic, $P = 0.076$; Table 1) as SBM inclusion was reduced in the diets. Absorbed N, retained N (g/d), and ATTD of N were decreased (linear, $P < 0.001$) as SBM decreased in diets, but retention of N (% of intake and % of absorbed) increased (linear, $P < 0.001$) as SBM decreased in diets. The DE decreased (linear, $P = 0.007$) as SBM decreased in diets, whereas SBM had no effect on ME. Dietary SBM also had no effect on ME to GE ratio, but ME to DE increased (linear, $P = 0.008$) by reducing SBM in diets.

CONCLUSIONS: In conclusion, diets containing intact protein from SBM had greater ATTD of GE and N, and greater DE, but reduced N retention rate when compared with diets containing crystalline AA. However, daily protein retention could not be maintained when crystalline AA rather than SBM were used to furnish the digestible AA in the diets, which may have negative consequences on carcass quality.

Digested purified adzuki bean (*Vigna angularis*) beta-vignin protein exhibits potential antidiabetic activity via stimulating the hepatic glucose uptake pathway *in vitro*

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INTRODUCTION: Adzuki bean is a legume that has a low glycemic index and is one of the beans traditionally used in Asian cultures to modulate type 2 diabetes (T2D). Human and animal studies have suggested that the consumption of adzuki bean has various health benefits including antidiabetic effects. Scientific research is needed to investigate the role of digested adzuki bean proteins in managing T2D. The objective was to assess and characterize the antidiabetic potential of digested adzuki bean beta-vignin (AB7S) protein and functional peptides in modulating hepatic glucose metabolism.

METHODS: Purified AB7S was hydrolyzed using the INFOGEST method. Bioactive peptides from the protein were identified and sequenced using LC-QTOF-MS/MS and the MassLynx V4.2 software. Computational molecular docking was used to assess the peptide functionality to inhibit the dipeptidyl peptidase IV (DPP IV) enzyme, modulating glucose metabolism. Validation of the DPP IV inhibitory activity was attained by luminescent detection. Human liver cells (HepG2) were treated with either digested AB7S obtained from simulated gastrointestinal digestion (10 µg/mL, 100 µg/mL, and 1000 µg/mL) or DPP IV inhibitor (gliptins). Cell viability (CV), glucose uptake (GU), and DPP IV activity in the cells were measured by MTS-CV, GU, and luminescence-based DPP IV inhibitory assays, respectively. The protein expression of glucose transporter 2 (GLUT 2), and markers of the protein kinase B (AKT)/p-AKT pathway were measured by ELISA and western blot. ANOVA and post-hoc tests were conducted, and $p < 0.05$ was considered statistically significant.

RESULTS: Purified AB7S (146 kDa) had a purity of > 90%. Peptide sequencing identified Val-Pro, Leu-Arg, and Pro-Val (molecular weights ranging from 214-741 Da) from the purified AB7S colonic digests. BIOPEP-UWM database showed that these peptides exhibited bioactivity as DPP IV inhibitors. Peptide Pro-Val (PV) (214 Da; PI: 5.69; hydrophobicity: 7.58 kcal/mol) showed the highest interaction with the DPP IV active site (-6.1 kcal/mol), like linagliptin, an FDA-approved diabetic medication. Three conventional hydrogen bonds were formed at Arg 358, Arg 669, and Glu 206. Digested AB7S (10-1000 µg/mL) did not affect CV. GU in the cells was ≥ 40% higher than the untreated control, suggesting that the digest was effective in increasing hepatic GU. CV of cells treated with 10 µg/mL (~25 µM) digested AB7S was the same as that of cells treated with 80 µM DPP IV inhibitor ($p > 0.05$). Hepatic GU was 40% higher than the untreated control after 10 µg/mL digested AB7S treatment, comparable to that of 40 µM DPP IV inhibitor ($p > 0.05$).

CONCLUSIONS: Digested AB7S was not harmful to hepatic cells at the concentrations tested and was effective in enhancing the hepatic GU pathway. Results suggest the effectiveness of digested AB7S in modulating markers related to type 2 diabetes, similar to a DPP IV inhibitor. Digested AB7S inhibited DPPIV and may guide the production of healthier adzuki bean-based products.

Poster Section: Nutritional Epidemiology

Cognitive outcome forecasting using supervised machine learning: A multi-factor analysis with anthropometrics, demographics, diet indices, and cardiovascular markers

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INTRODUCTION: This study utilized supervised machine learning (ML) models to predict cognitive performance based on a comprehensive set of health and behavioral factors, including physical activity and dietary patterns, which have been linked to reduced cognitive decline in the growing literature. The goal was to identify key contributors to cognitive function, enabling proactive cognitive health management through personalized interventions.

METHODS: Data from 380 adults (Age range: 19-82y, F: 228) was used to develop a supervised learning regression model predicting cognitive performance (reaction time) during a modified Eriksen Flanker task. Selected features included age, sex, ethnicity, income, education level, weight, height, waist circumference, body mass index (BMI), adherence to dietary indices (HEI [Healthy Eating Index], DASH [Dietary Approaches to Stop Hypertension], Mediterranean and MIND [Mediterranean-DASH Intervention for Neurodegenerative Delay]), weekly leisure-time activity (WLTA), and systolic and diastolic blood pressure. The dataset was split into a training and testing set (80:20). Predictive models (Decision Trees, Random Forest, Ada Boost, XG Boost, Gradient Boost) were deployed with hyperparameter tuning and cross-validation to ensure model generalizability. Feature importance scores (0-1) were computed using Mean decrease in Impurity to identify the most salient predictors. Performance was evaluated using mean absolute (MAE) and mean squared error (MSE).

RESULTS: Random Forest Regressor exhibited the best performance, with the lowest MAE on both the training (.599) and testing sets (.785), and lowest MSE on the training (.752) and testing sets (.985). Age was the most significant feature with the highest importance score (0.17), followed by diastolic BP (.125) and BMI (.1), WLTA (.075), HEI (0.07), DASH (0.04), MIND (.038). Ethnicity, Income and Education levels had minimal predictive effect on the model's performance (0-.01).

CONCLUSIONS: Understanding the collective impact of lifestyle factors on cognitive health is crucial for an aging population and the increasing prevalence of cognitive disorders. Modeling this relationship using robust ML models can inform health interventions tailored to individual risk profiles and formulate preventive strategies.

Increasing engagement and retention of vulnerable populations in nutrition research: The secret salsa of the MEXIMEDI personalized intervention

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INTRODUCTION: Culturally tailored nutritional interventions are crucial in bridging health gaps, providing personalized support to meet distinct dietary requirements, and promoting long-lasting health benefits. The MEXIMEDI Diet was a five-week culturally tailored pilot intervention to assess the feasibility of implementing a Mediterranean-style dietary pattern among Mexican-born adults living in the United States. Multiprong strategies were implemented to establish trust and increase participant retention, acquire longitudinal results, and ensure the overall success of a tailored intervention.

METHODS: In Phase 1, strategies included meal plan development by a Spanish-speaking registered dietitian that required several iterations and stakeholder consultation to incorporate cultural acceptance and feasibility. Participants were recruited via flyers, social media, and snowball sampling in the local area/surrounding counties. Elements of trust and familism were critical in this phase. In Phase 2, intervention implementation and guided interviews were conducted. Participants were randomized into two groups: the control group, MediDiet, and the MEXIMEDI intervention group. Meal plans were matched for macronutrients and adapted to each participant's eating preferences with compassionate and tailored interactions to maintain engagement. At the end, four semi-structured interviews (3 Spanish/1 English) were conducted to identify facilitators and barriers to program implementation and other elements contributing to its continuity.

RESULTS: Forty-two participants were recruited, 21 for MEXIMEDI and 21 for MediDiet. Thirty-four participants completed the study (81% retention rate), 20 in the MEXIMEDI group and 14 in the MediDiet group. The keywords in the qualitative analysis related to successful participation were: professional, respectful, flexible, supportive, and accommodating. Spanish-speaking staff and providing certain ingredients and kitchen tools increased engagement per findings. While both groups accepted the intervention, acceptance and retention were higher in the MEXIMEDI group. Barriers to the implementation included cost, education, and criticism/stigma.

CONCLUSIONS: Culturally tailored programs such as the MEXIMEDI Diet have the potential to shape the effectiveness, sustainability, and overall impact of interventions targeting vulnerable populations. The program promoted equal access to health resources and empowered individuals to make informed choices that align with their cultural values, ultimately fostering health equity. Through education, skill-building, and community engagement, participants are not only recipients of interventions but also active contributors to their health and well-being, allowing for long-term behavior changes.

Fecal microbiota and metabolites predict metabolic health features across various dietary patterns

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INTRODUCTION: Adhering to a healthy dietary pattern reduces the risk of developing metabolic diseases and nourishes the gut microbiota. Thus, understanding how the gut microbiota may underpin connections between diet and metabolic health is of great clinical interest. Herein, we examined the contributions of bacterial taxa and metabolites in predicting metabolic health features across dietary patterns in a cohort of 118 adults.

METHODS: Metabolic health features included waist circumference, blood pressure (BP), and fasting blood glucose, triglyceride (TG), and HDL concentrations. Four dietary pattern scores were derived from the Diet History Questionnaire (DHQ): Dietary Approaches to Stop Hypertension (DASH), Healthy Eating Index-2020, Mediterranean Diet, and Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND). ANCOM-BC was used to identify differentially abundant bacteria across dietary patterns. Fecal volatile fatty acid and bile acid concentrations were measured via GC-LC and LC-MS/MS, respectively. Hierarchical linear regression (HLR) was used to assess the contributions of individual fecal bacteria (Step 2) and metabolites (Step 3) in predicting metabolic features across each dietary pattern (Step 1) while adjusting for sex, age, BMI, self-reported physical activity, and household income.

RESULTS: DASH diet was the greatest predictor of systolic and diastolic BP in Step 1 models. Further examination of connections between DASH and BP revealed that models were improved by adding Eubacterium eligens (systolic R2 = 0.27; diastolic R2 = 0.22) and E. xylanophilum (systolic R2 = 0.30; diastolic R2 = 0.25) independently in Step 2. Adding deoxycholic acid (Step 3) with E. xylanophilum resulted in the best overall model fit (systolic R2 = 0.32; diastolic R2 = 0.26). MIND diet tended to predict TG concentrations in Step 1 ($p = 0.06$). Adding E. eligens in Step 2 improved the model (R2 = 0.16), with the greatest overall model fits observed when isobutyrate (R2 = 0.22) and isovalerate (R2 = 0.20) were independently incorporated in Step 3.

CONCLUSIONS: This exploratory analysis identifies specific fecal bacteria and microbial metabolites that may contribute to the effect different dietary patterns have on metabolic health parameters.

Poster Section: Dietary Patterns

Dietary intake and depression status among college students: A pilot study

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INTRODUCTION: Evidence suggests the composition of dietary intake may be associated with depression onset and symptom severity. However, much of the research has been conducted in older adults despite the prevalence of depression increasing in recent years among college students, while dietary intake remains suboptimal among this age group. Therefore, the aim of this pilot study is to assess dietary patterns and nutrient intake in relation to depressive symptom severity among college students.

METHODS: Surveys were disseminated to 281 college students. The Center for Epidemiologic Studies Depression Scale (CES-D) was included in the survey. CES-D total scores indicated mild (scores: 10–15), moderate (scores: 16-24) or severe (scores: ≥25) self-reported depression symptoms or no depression (0-9). Food intake was assessed using survey questions related to the 10 food categories highlighted by the "Mediterranean-DASH Intervention for Neurodegenerative Delay" (MIND) diet. A subsample of Black student respondents (n=38) completed food diary entries from two weekdays and one weekend day. The data was then entered into the Nutrition Data System for Research (NDSR) software to assess nutrient intake.

RESULTS: Over half of the survey participants (59%) self-reported moderate to severe depression and 55% of the subsample self-reported similar depression symptom severity status. Survey responses to the MIND diet-related questions found only 29% of respondents consumed vegetables daily compared to over 50% indicating consumption of fried foods multiple times per week. Among the subsample of black college student participants, food diaries also indicate multiple micronutrient deficiencies associated with depression, including vitamin D and magnesium.

CONCLUSION: Preliminary data indicates many participants self-reported high levels of depressive symptom severity while also reporting low intake of daily food groups (i.e. vegetables). Furthermore, food diaries indicate deficiencies in micronutrients associated with depression status. Future analyses upon completion of the study may confirm significant associations among dietary intake, nutrient deficiencies, and depression status.

Study protocol for the mind pilot intervention: Measuring the effects of diet on cognition and metabolic health

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INTRODUCTION: The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) is a dietary pattern linked to reduced cognitive decline in older adults, however, the effect of the MIND earlier in life is understudied. Our previous data show that MIND adherence is associated with greater cognitive function and metabolic health in middle-aged adults. Additionally, we have identified dietary lutein to be disproportionately high in the MIND relative to other diet patterns. This pilot study aims to prospectively test the effect of the MIND on cognition in middle-aged adults. Our primary hypothesis is that relative to the control group, participants receiving the MIND will exhibit greater gains in cognitive function, and this effect will be mediated by changes in cardiometabolic health and lutein accumulation in neural tissue.

METHODS: Healthy adults (N=48) aged 45-64 will be recruited for a randomized-controlled, single-blind clinical trial with two treatment groups: MIND pattern (N=24); or general diet (N=24). The intervention will consist of one ready-to-eat meal per day for 12 weeks plus respective diet education. MIND meals will provide a 6-fold increase in dark green leafy vegetable servings, a 2-fold increase in berries and legumes, 3-fold increase in nuts, and 4-fold increase in olive oil consumption weekly relative to the control. MIND meals will provide nearly 5-fold more dietary lutein than the control. Cognitive function, macular pigment, blood, and vascular health markers will be collected at baseline and following 12 weeks of the intervention. Cognitive function will be assessed using a modified Eriksen flanker task with event-related potentials. Fasting blood triglyceride, glucose, and high-density lipoprotein cholesterol concentrations will be quantified using a Piccolo Express analyzer. Vascular health will be indexed by pulse wave velocity and collected using the SphygmoCor® XCEL device. Neural lutein will be indexed by macular pigment optical density (MPOD).

CONCLUSIONS: We expect that MIND consumption will increase cognitive performance and that benefits in cognition due to the MIND will be mediated by changes in MPOD and cardiometabolic health.

Nutritional and physiological impact in adipose tissue of a ketogenic diet while ameliorating MAFLD symptoms

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INTRODUCTION: Nonalcoholic fatty liver disease (NAFLD) prevalence has been set to increase its prevalence to 34.2% in 2050 among US adults. To ease its bedside diagnosis a new term was suggested in 2020 in order to increase its prevention by relating it to systemic metabolic dysregulation: metabolic dysfunction-associated fatty liver disease (MAFLD). One important factor that triggers development of this disease is obesity, a chronic multifactorial disease that is considered to be a worldwide epidemic. NAFLD is the second cause of liver transplant in the US, however dietary treatment in early stages can help to control the progression of this disease. Multiple clinical and animal studies have been evaluating the anti steatotic effect low-carbohydrate ketogenic diet (LCKD) in order to establish it as a possible treatment. Although it has shown ameliorating results in MAFLD symptoms, there are still several concerns around collateral effects in other tissues and mechanisms which remain unclear. As an alternative lipid storage organ, adipose tissue (AT) is a key target to study under these conditions. It is also in charge of providing free fatty acids and glycerol through the circulatory system to the liver under fasting and low glucose conditions as a source of energy. Using the NuTRAP technology, we can address the AT transcriptomic and epigenomic differences, since it allows simultaneous isolation of adipocyte mRNA and nuclei using an adiponectin-cre line.

METHODS: Recent data showed how a low-carb KD diet works well for MAFLD treatment, improves insulin resistance and reduces hepatic fat deposits. We've previously shown that BA are important for adipocyte size maintenance, affecting AT remodeling and fat burning and its signaling receptor loss, farnesoid x receptor in AT results in MAFLD, indicating a liver to AT cross talk. Therefore, we'll test if BA levels or their downstream signaling are altered with low carb KD intervention. Using the NuTRAP mice model, we'll perform adipose transcriptome and epigenome analysis.

CONCLUSIONS: We expect to uncover the BA signaling role to mediate the beneficial response to low carb KD. The genome-wide studies with NuTRAP mice will reveal the transcriptomic changes, along with the biochemical data from serum analysis to also help us decipher the mechanism underlying KD-mediated MAFLD treatment.

Poster Section: Dietary Bioactive Compounds II

Intestinal and hepatic histology is altered by soluble fiber consumption in an FXR-dependent manner

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INTRODUCTION: Farnesoid X receptor (FXR) is a nuclear bile acid (BA) receptor with multiple physiological functions across disparate organ systems. Such functions include BA synthesis, BA trafficking, and regulation of cellular proliferation, which highly influences the function of organs such as the intestine and liver. However, BA composition varies across the gut-liver axis, thus influencing FXR activation and function. Furthermore, dietary modification, particularly fiber consumption, alters host and microbial BA metabolism. The objective of this study was to understand how soluble fiber alters enterohepatic histology in an FXR-dependent manner.

METHODS: A total of (n=46) 9–10-month-old mice were utilized in a 2x2x2 study design (diet by genotype by sex). Diets were a fiber-free diet (FFD) vs a 10% beta-glucan, 10% cellulose diet (BG). Genotypes included wild type (WT) vs FXR-SHP double knockout mice (DKO). Hematoxylin and eosin staining were used to identify crypt depth and villus height morphology along the gastrointestinal tract. Liver histology was examined using Hall's bile and trichrome staining.

RESULTS: Bile staining indicated more hepatic bile accumulation in WT-FFD vs all other groups (all $p < 0.05$). Trichrome staining demonstrated less collagen formation in WT-BG compared to all other groups (all $p < 0.05$). Ileum villus height and crypt depth were higher in DKO vs WT ($p=0.004$ and $p=0.003$ respectively) and females compared to males ($p=0.03$ and $p=0.007$ respectively). Cecum crypt depth was lower in WT-FFD vs all other groups (all $p < 0.05$). Distal colon crypt depth was lower in WT-BG vs all other groups (all $p < 0.05$).

CONCLUSION: Both hepatic and intestinal histology were impacted by soluble fiber consumption in both segment and FXR-dependent manners. This highlights the importance of FXR signaling on the structure and function of the enterohepatic axis. Ongoing studies are investigating the expression of genes regulated by FXR related to gut-liver axis physiology.

Psychological stress and dietary fiber regulate markers of inflammation and anxiety

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INTRODUCTION: Prolonged stress exposure stimulates physiological release of pro-inflammatory molecules such as chemokine CCL-2 that initiate neuroinflammation, a contributor to psychopathological conditions including depression and anxiety. Prebiotic dietary fiber can ameliorate depressive-like behavior, suggesting that it may be a promising therapeutic for neuroinflammation-driven psychopathological conditions. Therefore, the purpose of this study was to examine the effects of psychological stress and prebiotic fiber supplementation on serum CCL-2 and anxiety- and depressive-like behavior.

METHODS: Male and female C57BL/6 mice (age 6-8 weeks, n=6, N=96) were randomized into sixteen groups with factors of sex (male/female), two weeks of diet (1. Fiber-free diet [FFD] (base diet), 2. FFD + 20% cellulose [CELL] [non-prebiotic fiber control], 3. FFD + 10% cellulose + 10% short-chain fructooligosaccharide [scFOS] [short-chain prebiotic fiber], or 4. FFD + 10% cellulose + 10% inulin [INU] [long-chain prebiotic fiber]), and two hours of daily restraint stress exposure during the second week on diet (stressed [S] vs non-stressed [NS]). On day one of restraint, blood was collected at 0, 30, 60, 90, 120 min, and one hour post-stress (180 min) for quantification of CCL-2 via ELISA. Mice underwent open field and nest building tests to assess behavior. Spleen mass was collected as a marker of immune activation.

RESULTS: Spleen mass was higher in females ($p=0.01$). Female CELL had lower spleen mass vs other diets (all $p<0.001$). Male S-FFD had higher spleen mass vs NS-FFD ($p=0.04$). Total distance traveled in the open field was higher in females ($p<0.00001$), and tended to be higher in S-FFD vs NS-FFD ($p=0.06$). S-males spent more time in the central zone ($p=0.02$). Nest building score was higher in S-FFD and S-scFOS vs other conditions (all $p<0.05$). During the first bought of stress, CCL-2 was higher at 180 min in S-INU and S-scFOS vs S-FFD and S-CELL (all $p < 0.05$).

CONCLUSION: Short-term dietary fiber intake regulates some markers of inflammation and affective disorders in a sex-dependent manner, likely via the gut-brain axis. CCL2 remains a potential target for the treatment of these diseases, but our results highlight the need to better understand its role in stress-induced conditions. Ongoing studies are examining makers of neuroinflammation in the central nervous system.

Soy isoflavone consumption is associated with greater attentional inhibition among school-aged children

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INTRODUCTION: Soy isoflavones are phytoestrogens present in soy foods that may have beneficial effects on cognition. Although the effects of soy isoflavones have been studied in adults, their potential health benefits in children remain unclear. This study aimed to understand the cross-sectional relationship between habitual soy isoflavone consumption and cognitive abilities in school-aged children. We hypothesized that increased soy isoflavone consumption would be associated with better cognitive performance.

METHODS: Cross-sectional analyses were conducted using secondary data among children ages 7 – 12 years (n = 128). Habitual total isoflavone intake (i.e., genistein, daidzein, glycitein) and overall diet quality (i.e., Healthy Eating Index 2015 [HEI-2015]) were assessed using 7-day diet records. General intellectual ability (GIA) was measured using the Woodcock-Johnson III Tests of Cognitive Abilities. A modified Eriksen Flanker task was used to assess attentional inhibition. The P3 event-related potential (ERP) was measured from electroencephalographic activity during the Flanker task to index information processing speed (e.g. P3 peak latency) and attentional resource allocation (e.g. P3 peak amplitude).

RESULTS: Partial Spearman correlations controlled for age, sex, HEI-2015, Body Mass Index, and household income. Total isoflavones were negatively related to flanker incongruent reaction time (rho = -0.22, p = 0.02). Total isoflavones were also positively related to incongruent FPZ P3 mean amplitude (rho = 0.22, p = 0.04). There was no significant relationship between total isoflavone intake and GIA.

CONCLUSIONS: Soy isoflavone intake was positively associated with behavioral performance in attentional inhibition but not intellectual abilities among school-aged children. Additionally, the ERP findings suggest that habitual soy isoflavone intake is associated with faster information processing speed during an attentional inhibition task. Future intervention studies are necessary to prospectively test the effects of soy isoflavone consumption on differential aspects of cognitive function.

Plant-based foods being surveyed for a clinical trial in children

Research image by Ajla Bristina

Poster Section: Food Science and Microbial Metabolism

Tailoring microbial amino acid metabolism in fermented foods to enhance nuclear receptor activity and regulate experimental colitis severity

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INTRODUCTION: While consumption of fermented foods has been shown to have anti-inflammatory effects, the source(s) of bioactivity within these foods have not been characterized. We previously found methods to enhance microbial aromatic metabolism towards increased production of bioactive metabolites within a whole food matrix. Here, we tested the ability of these modified food matrices to: 1) activate nuclear receptors- Peroxisome proliferator-activated receptor gamma (PPARg) and aryl-hydrocarbon receptor (AhR) ex vivo and 2) dampen colitis severity in dextran sulfate sodium (DSS) treated mice.

METHODS: Yogurt (starter culture S. thermophilus, L. bulgaricus) was supplemented with metabolic cofactors alone or in combination with bacterial strains previously tested for aryl-lactate [e.g. phenyllactic acid (PLA) and indolelactic acid (ILA)] producing capacity. After fermentation and 4wk cold storage, food matrices were analyzed for aryl-lactates by LC/MS/MS and nuclear receptor bioactivity measured ex vivo using AhR and PPARg reporter cell lines. In a subsequent experiment, C57Bl/6 mice received control yogurt or yogurt conditions optimized for aryl-lactates (n=6/group) for 7 ds prior and during 7ds of treatment with 2.5% DSS in drinking water to induce moderate colitis. Colitis severity will be assessed by colonic shortening, body weight loss and pathological indices after 3 ds of recovery from DSS. We hypothesized that food matrices optimized for increased ILA and PLA will augment AhR and PPARg receptor activity, respectively, and will promote colitis recovery.

RESULTS: Augmented microbial metabolism towards production of aryl-lactates robustly enhanced the ability of fermented food matrices to activate AhR both immediately post-fermentation and after 4wk cold storage ($p<0.01$). Yogurt with standard starter culture conditions exhibited AhR activity similar to commercially available yogurts ($p>0.05$). We found that food matrix conditions that most robustly augmented the aryl-lactate ILA, also most effectively enhanced AhR activity ($p<0.05$). Additionally, preliminary testing revealed food matrices with elevated PLA have capacity to activate PPARg. In light of reduced AhR and PPARg signaling as etiologic factors in inflammatory bowel diseases, we are currently testing whether fermented food (yogurt) optimized for aryl-lactates, including ILA and PLA, can synergize to enhance recovery from an acute experimental (DSS) colitis challenge.

CONCLUSIONS: Conditions formulated for increased production of microbial aryl-lactates increased ability of fermented food matrices to activate AhR. We are leveraging these results to determine if increased AhR and PPARg activity of fermented foods enhance recovery from acute experimental colitis. Together, these data provide insight into bioactive components within fermented foods and reveals methods to enhance select aspects of microbial fermentation to improve health.

Quantifying and characterizing the fiber in Hass avocados during the ripening process

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INTRODUCTION: Hass avocados are a subtropical fruit from the Persea americana tree that have gained commercial interest in the last three decades due to its flavor and nutrient profile. Consuming avocados provides an array of nutrients such as vitamins, minerals, healthy fats and dietary fiber (DF). However, there are some inconsistencies in the amount of DF reported in avocados, ranging from 3.9-6.7g of DF per 100g of fresh fruit. Additionally, the characterization of such fibers in avocados is limited, with studies focusing on pectin polymerization and solubility but not the type (e.g., rhamnogalacturonan, homogalacturonan, arabinogalactans, etc.). Further, both amount and type of DF can be modified with fruit ripening, which then affects the bio accessibility. Therefore, the aim of the study was to characterize the amount and type of DF in Hass avocados and evaluate DF changes during ripening.

METHODS: Hass avocados (Persea americana; ~12-d transit time from harvest to receipt) were ripened at 21□C and 24% relative humidity for up to 12 d in our research facility. Avocados were divided into three ripening stages (RS): RS-1=unripe (day 0), RS-2=ripe (day 5), and RS-3=overripe (day 12), with each RS containing 12 avocados. Avocados were freeze-dried and defatted using the Soxhlet method. DF analysis was conducted using an enzymatic-chemical method, which measures DF as the sum of hydrolyzed monosaccharides, cellulose, and lignin. DF was determined on a dry-matter basis (DMB) and converted to an "as-is basis."

RESULTS: RS-1 contained 3.96g total DF, RS-2 contained 3.68g total DF, and RS-3 contained 3.26g total DF per 100g of "as-is" avocado. The DF in RS-2 was 43.2% (1.59g/3.68g of DF from fresh fruit) soluble dietary fiber (SDF) and 56.8% (2.09g/3.68g of DF from fresh fruit) insoluble dietary fiber (IDF). In RS-2, the main component of the SDF was rhamnogalacturonan-1 and arabinan pectins, as evidenced by the presence of uronic acids, rhamnose, arabinose, and galactose, which represented 60.3%, 24.5%, 6.8% and 2.9%, respectively, of soluble monosaccharides. IDF was predominantly cellulose (56.3%), followed by hemicelluloses (40.3%), including xyloglucan, xylans, and glucomannan. RS-2 avocados contained the greatest amount of DF and SDF on a DMB, followed by RS-1 and RS-3. On an as-is basis, SDF remained highest in RS-2. However, DF tended to decrease with ripening. Pectin was extensively solubilized and depolymerized during ripening, whereas cellulose and hemicellulose remained relatively unchanged.

CONCLUSIONS: The total amount of DF in ripe (RS-2) Hass avocados (3.68g/100g) was similar to the mean pooled data from previous reports (3.87g/100g). Novel findings revealed that the types of DF in avocados are predominantly pectin, followed by cellulose and hemicellulose. These findings are important because the chemical structure and physicochemical properties of different fibers underpin health benefits, including intestinal microbial fermentation following consumption.

Indoleamine 2, 3 dioxygenase (IDO1) differentially regulates microbial aromatic amino acid metabolites and colonic inflammatory tone in aged versus young mice

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INTRODUCTION: Indoleamine 2, 3 dioxygenase (IDO1) is a rate-limiting enzyme that metabolizes tryptophan to kynurenine (KYN). Accumulation of KYN is suggested as a key factor underlying IDO1-driven immune dysfunction associated with aging, yet studies remain inconclusive. Aromatic amino acid metabolites (ArAAs; e.g. tryptophan) are also metabolized by the gut microbiota into a wide variety of bioactive metabolites ('micro-aryls') that may regulate IDO1-directed immune dysfunction, but this has never been explored. First, we investigated how the gut microbiome, micro-aryls, and gut inflammatory tone are regulated by 1) Age and 2) IDO1 activity. We hypothesized that advanced aged would deplete micro-aryls in WT mice but not mice without IDO1 (IDO1KO). We also expected a rescue of aging-induced microbial dysbiosis and colonic inflammation in IDO1KO mice.

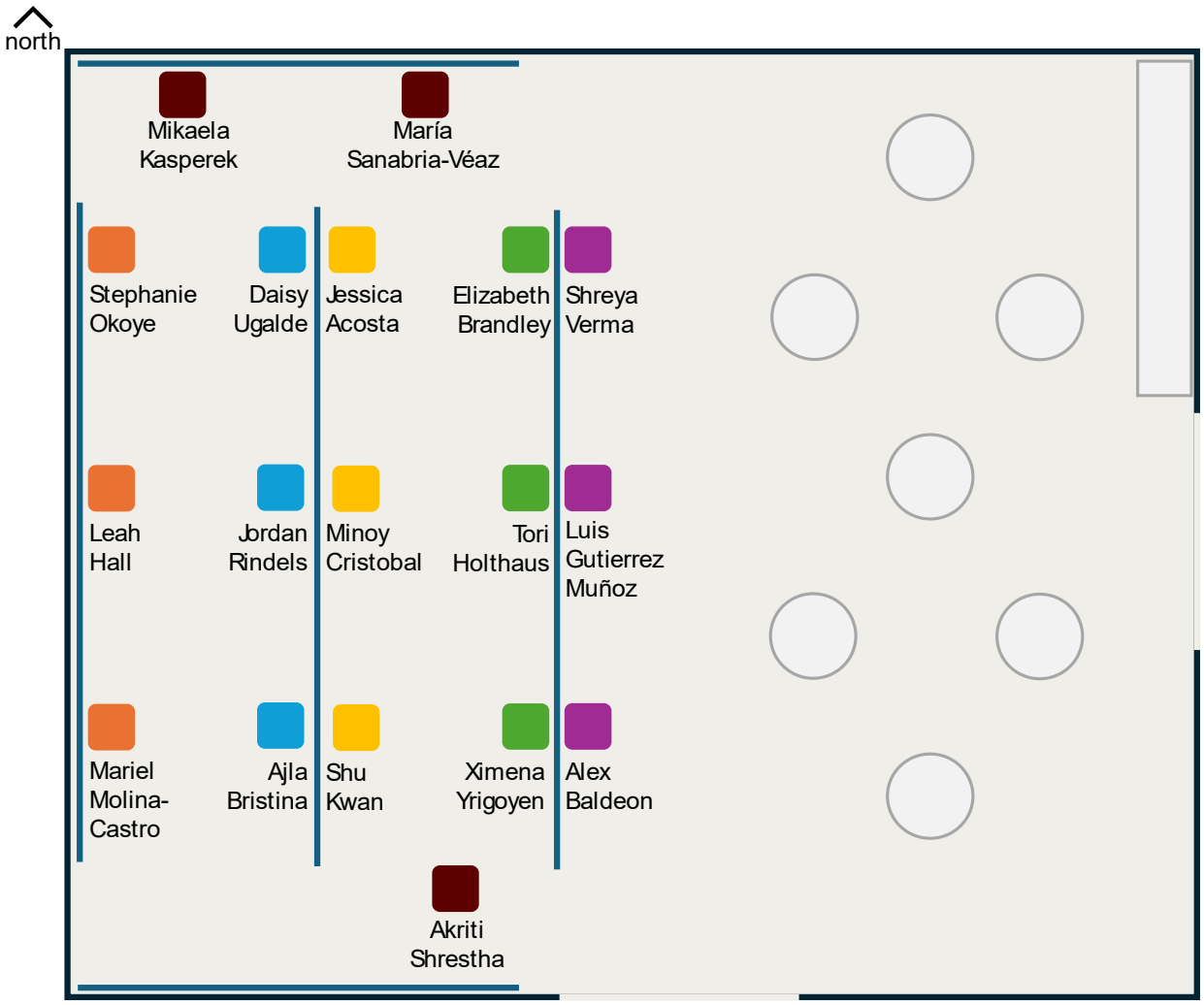
METHODS: Young WT and IDOKO (n = 6-8 per group; 12-22 wks age), and aged WT and IDOKO (n=10 per group; 114-138 wks age) were sacrificed and colon content and colon tissue were harvested. Serum and colonic contents were analyzed by targeted LC/MS/MS for micro-aryls. Colon content was analyzed by 16S rRNA sequencing and proximal colon tissue analyzed for inflammatory tone through a custom rtPCR Fluidigm assay.

RESULTS: The tryptophan-derived micro-aryl indole-lactate (ILA), which has anti-inflammatory properties, was reduced in colon contents of aged WT mice, but rescued in IDOKO mice ($p < 0.05$) Meanwhile, other tryptophan metabolites with immune modifying properties, including indole-propionate and indole-acetate, were significantly elevated in colon contents of IDOKO aged mice only ($p < 0.05$). In the serum, ILA and phenyllactate (PLA), the latter a phenylalanine derivative, were significantly reduced in aged WT mice (vs young), but this effect was reversed in aged IDOKO mice ($p<0.05$). IDOKO mice of both young and aged cohorts exhibited altered microbiome communities vs. WT counterparts. Bifidobacterium sp, which has anti-inflammatory potential and is a known micro-aryl producer, was elevated in IDOKO mice. In contrast pathobionts with pro-inflammatory potential, such as Helicobacter hepaticus, were also elevated in IDOKO mice, suggesting a complex role of IDO1 in regulating microbiome characteristics. Expansion of Helicobacter hepaticus corresponded to enhanced colonic inflammatory signaling, including elevated expression of Lbp, Tnfrsf1b, S100a8, S100a9 and Ccr2 in the colons of IDOKO vs. WT aged mice.

CONCLUSIONS: IDO1 activity regulates micro-aryls concurrent to shifts in the gut microbiome and colonic inflammatory tone. IDO1 effects on the gut microbial metabolism were more robust in aged vs. young animals. Current studies are examining how ID deficiency regulates chronic inflammation and microbial dysbiosis associated with age. Future studies are needed to clarify the immune modifying capabilities of micro-Aryls and their connection to IDO1 activity and chronic immune activation.

Graduate Student Poster Session Location:

iHotel & Illinois Conference Center
Alma Mater Room
Poster Session 1: 11:00 a.m. - 12:00 p.m.
Poster Session 2: 4:00 p.m. - 5:00 p.m.



- Nutritional Epidemiology
- Dietary Bioactive Compounds I
- Sensory Nutrition
- Dietary Patterns
- Dietary Bioactive Compounds II
- Food Science & Microbial Metabolism

Notes

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