2020 AOCS Annual Meeting & Expo Health and Nutrition Abstracts

June 29 to July 3, 2020

Hosted online by the American Oil Chemists' Society (AOCS)

For more information, please visit https://annualmeeting.aocs.org.

Presentations dated Friday, January 1, 2021, were provided on-demand.

Health and Nutrition

Monday, June 29, 2020

Session Time: 8:25 AM - 10:10 AM

Presentation Time: 8:25 AM - 8:30 AM

Track: Health and Nutrition

Introduction: Health Benefits of Food Proteins and Peptides

Co-Chair: Curtis. B Rempel - Canola Council of Canada
Co-Chair: Hitomi Kumagai, PhD - Nihon University
Co-Chair: Kaustav Majumder, PhD - University of Nebraska-Lincoln

This session provides a brief overview of the current scientific knowledge, future research directions and commercial application of food proteins and peptides in human nutrition. Food protein-derived peptides and amino acids are well known for their nutritional value. Recent studies have demonstrated that dietary proteins, specifically protein-derived peptides, can modulate physiological functions and exhibit health-beneficial biological activity above and beyond their known nutritional value. This topic has attracted significant commercial attention around the world, especially with the upsurge of using plant-derived proteins and proteins from alternative food sources.

Monday, June 29, 2020
Session Time: 10:25 AM - 12:45 PM

Presentation Time: 10:25 AM - 10:30 AM

Track: Health and Nutrition

Introduction: Dietary Cannabinoids and Health

Co-Chair: Eileen Bailey, DSM Nutritional Products, USA - DSM
Co-Chair: Robert Ward, Utah State University, USA

This session highlights some of the leading research on dietary cannabinoids and health. The health benefits of cannabinoids are an exciting area of research. Preparations form cannabis have been used in medicine for millennia. Numerous diseases, such as anorexia, emesis, pain, inflammation, multiple sclerosis, neurodegenerative disorders (Parkinson's disease, Huntington's disease, Tourette's syndrome, Alzheimer's disease), epilepsy, glaucoma, osteoporosis, schizophrenia, cardiovascular disorders, cancer, obesity, and metabolic syndrome-related disorders, to name just a few, are being treated or have the potential to be treated by cannabinoid-related compounds.

Monday, June 29, 2020
Session Time: 10:25 AM - 12:45 PM

Presentation Time: 10:30 AM - 11:20 AM

Track: Health and Nutrition

Cannabinoids & Health

Presenting Author: Laura Lagano, MS, RDN, CDN - Laura Lagano Wellness

Monday, June 29, 2020
Session Time: 10:25 AM - 12:45 PM

Presentation Time: 12:10 PM - 12:35 PM

Track: Health and Nutrition

Synthetic Biology and Cannabinoids

Presenting Author: Ross Zirkle, PhD - DSM

Historically, cannabinoids have been defined as terpenophenolic molecules from the plant Cannabis sativa. With a better understanding of the human endocannabinoid system, the term cannabinoids now refers to any ligand of the cannabinoid receptors regardless of origin. Cannabis sativa has been shown to produce approximately 90 different cannabinoids. The two best-known and studied cannabinoids are delta-9-tetrahydrocannabinol (THC), which is responsible for the psychoactive effects of cannabis and non-psychotropic cannabidiol (CBD), which has gained popularity with consumers with products claiming health benefits from mood

enhancement to sleep regulation . The study of non-psychotropic cannabinoids has proven difficult due to their association with the tightly regulated cannabis industry. The changing landscape of regulation and consumer acceptance of the potential benefits of cannabinoids has led to intense scientific activity in many areas of cannabinoid research. One area of technological interest is the use of synthetic biology to produce cannabinoids. This presentation will review the benefits and challenges as well the current status and outlook for the utilization of synthetic biology for the production of these emerging compounds.

Tuesday, June 30, 2020
Session Time: 10:25 AM - 12:35 PM

Presentation Time: 11:45 AM - 12:10 PM

Track: Health and Nutrition

(4187) The Brave New World of Oils...where are we going?

Presenting Author: Alejandro G. Marangoni, PhD - University of Guelph

The world of fats and oils has changed. Fats are evolving from commodities to become sophisticated foods. We can almost talk about an Olive Oil Terroir, where the origin of the olives influences quality and consumer perception. Oils have also become an important part of our currently psyche - sustainability, habitat destruction, climate change, pesticides, water usage, carbon footprint. Palm oil has been greatly affected by this, and Malaysia now produces certified Malaysian Sustainable Palm Oil (MSPO). Without such a change, the palm oil business in American and Europe would be greatly diminished. Nutrition and Health are also in the mind of consumers. Red Palm Oil, Extra Virgin Olive Oil, cold-pressed oils, all invoke the intake of healthful, micronutrient-rich oils, good for your health. But what exactly is 'good for you' or 'healthy'. Does it mean that it is not toxic, or that its long-term consumption has a health benefit? If you eat too much oil, you are probably eating too many calories, which can lead to obesity and type-2 diabetes. Therefore, are all oils 'unhealthy'? On top of all of this, we have an enormous push towards vegan products. Will this be the end of tallow and lard and possibly butter? What are they going to be replaced with? Maybe we will also move towards 'fair trade' oils, where farmers are paid more for their crops and we thus decrease rural poverty. This talk will focus on the current and future trends affecting the oil trade and will also review the possibly effects that excessive or insufficient and oil consumption can have on health.

Wednesday, July 1, 2020
Session Time: 8:25 AM - 11:20 AM

Presentation Time: 9:55 AM - 9:55 AM

Track: Health and Nutrition

(3959) Increased android body fat is associated with lower serum β-carotene in U.S. adults

Presenting Author: Ambria Crusan, MS, RD, LD - University of Minnesota

Objectives: Multiple studies have demonstrated a positive relationship between adiposity, especially visceral adiposity, and cardiometabolic diseases. Longitudinal studies have shown an inverse relationship between serum β-carotene (BC) and cardiometabolic diseases; however, the relationship between serum BC and location-specific body fat percentage in population samples has not been assessed. Our primary objective was to determine the association between adiposity and serum BC concentrations utilizing datasets from the National Health and Nutrition Examination Surveys (NHANES). Methods: Data were obtained from NHANES 2003-2006 using multistage probability sampling. Android fat percentage (AF%) and gynoid fat percentage (GF%) measured by dual energy x-ray absorptiometry and serum BC concentrations for 3,833 male and non-pregnant female participants aged 20-85 years in the United States were assessed. Correlations were assessed between variables. Multivariable linear regression modeled serum BC concentrations (ln transformed) on body fat percentage adjusted for reported BC intake, age, sex, and race/ethnicity. Results: Mean and SE ln BC and AF% were 2.49±0.04 μg/dL and 36.88±0.21%. Serum BC concentrations were inversely associated with AF% ($r= -0.10$, $p<0.0001$). No significant correlations were present between serum BC and GF% ($p<0.06$), reported dietary intakes and AF% ($p=0.07$), or GF% ($p=0.16$). For adults of the same age and sex, each 1 ug/dL increase in serum BC concentrations, abdominal adiposity decreased by 0.02% ($p<0.0001$). Conclusions: In representative sample of adult US men and women, serum BC concentrations were associated with lower AF% but not GF%, independent of dietary intake.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4204) Cannabis Phytochemical Studies for Small and Large Animals

Presenting Author: Stephen Cital - ElleVet Science

The clinical data for companion animals with the use of phytocannabinoids has thus far been lacking. Some of the first clinical safety and efficacy studies have only recently come out. Join us for this session on some of the new safety, PK, metabolite and in vitro oncology studies recently completed to help keep you informed on the latest data for such a hot topic.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4235) Bioavailability of cannabinoids – how to prevent adverse effects

Presenting Author: Graham Wood, Neptune Wellness Solutions

The bioavailability of cannabinoids have been extensively studies across may different delivery forms from inhalation of combustion or vaping to sublingual, transdermal and ingested. Furthermore, for ingested forms, a fair bit of research has looked into food effects. The different delivery forms each has advantages and disadvantages but most importantly the Cmax and AUC of each delivery form differs tremendously. Unfortunately, there is currently a lack of understanding for physicians and consumers, which can lead to fairly significant adverse events. We will review the different delivery forms and the pharmacokinetic profile to expect from each and look at strategies to limit adverse events.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4217) How Quantitative and Kinetic Approaches to Studying Brain Docosahexaenoic Acid Metabolism Led to New Methods, Questions and Some Answers

Presenting Author: Richard P. Bazinet - University of Toronto

This lecture will focus on translational studies in omega-3 metabolism that my lab has contributed to. Upon learning quantitative and kinetic approaches to study fatty acid metabolism with Stephen Cunnane and Stanley Rapoport, I established a laboratory at the University of Toronto with a focus on these acquired skills. By studying the mechanisms of uptake of docosahexaenoic acid (DHA) into the brain in preclinical models, we were able to contribute to the first estimates of human brain DHA uptake and, thus, requirements in humans. Estimates of how much DHA the human brain needed led to new questions about how diet could supply the brain with DHA. We then developed quantitative steady-state infusion approaches to measure DHA synthesis from its dietary precursors in preclinical models. While we were able to translate our steady-state infusion models to humans, it was apparent that a less invasive method was needed. Recently we stumbled across natural abundance carbon isotope ratio analysis and developed methods to distinguish between DHA and its precursors. Within just a few years of developing new methods, we were able to translate and confirm several of our preclinical findings to humans, including rapid flux though the omega-3 pathway and a lack of DHA retroconversion in humans. While new methods have given us insight into metabolic pathways and nutrition, they have raised many more questions.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(3786) Very Long Chain PUFAs in marine oils – "New" molecules with important role for human health

Presenting Author: Iren Stoknes - Epax Norway AS

Marine oils are well known for the content of Long Chain Poly-Unsaturated Omega3 fatty acids (LCPUFA), like the health promoting EPA and DHA fatty acids. What is not so known is that marine oils consist of a small amount of Very Long Chain Omega3 PUFAs (VLCPUFA); fatty acids with at least 24 carbon in the chain and with at least 3 double bonds. Within the mammalian body VLCPUFA are present in noticeable concentrations in retinal tissue, brain, testes and spermatozoa. VLCPUFA are required for a healthy retina and for male fertility, and appear to play an important role in brain physiology. Epax has investigated the content and identity of VLCPUFA in marine oils, and has developed a process for concentrating the fatty acids. The study resulted in identification of C24:4-6, C26:4-7, C28:4-8 and C30:5-6 fatty acids in fish oils. Epax has performed studies of diet uptake and distribution of VLCPUFA in tissues of mice. Results will be presented. It will be important to build up more science and knowledge around metabolism and health effects in humans and animals of these unique omega3 fatty acids in marine oils.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4188) Potential Health Benefits and Controversies of Ketones, Medium Chain Triglycerides and Ketogenic Diets

Presenting Author: Stephen C. Cunnane, PhD - Research Center on Aging

Ketogenic diets (KD) and ketogenic medium chain triglycerides (MCT) raise ketones (beta-hydroxybutyrate and acetoacetate) and confer certain therapeutic benefits in conditions as diverse as epilepsy, cancer, Alzheimer disease, Parkinson disease, type two diabetes and obesity. Nevertheless, ketones have long been associated with metabolic acidosis in untreated type one diabetes. However, pathological ketosis involves ketone levels 5-10 times those of nutritional ketosis and the latter does not induce metabolic acidosis. KD and MCT also provide an intake of saturated fat that exceeds most recommendations. Hence, ketogenic supplements and KD are controversial despite their popularity and their clear beneficial effects in some diseases. Presently available data do not support an increased metabolic or cardiovascular risk of consuming MCT or a KD in young or older adults; in fact, the opposite is more frequently observed. Financial or

other support from CIHR, NSERC, Mitacs, FRQS, FRQNT, Fondation Vitae, Alzheimer Association USA, Nestlé, Abitec, Bulletproof, and Cerecin.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4065) A ketogenic drink improves brain energy and some measures of cognition in MCI

Presenting Author: Stephen C. Cunnane, PhD - Research Center on Aging

Introduction: Unlike for glucose, uptake of the brain's main alternative fuel, ketones, remains normal in mild cognitive impairment (MCI). If impaired brain energy metabolism is linked to the onset of MCI or its progression to Alzheimer's disease, ketogenic medium chain triglycerides (kMCT) could potentially improve cognitive outcomes in MCI by providing the brain with a fuel that bypasses impaired glucose metabolism. Methods: 52 MCI were randomized to 2 X 15 g/d of kMCT or matching placebo. At baseline and at the end of the intervention 6 months later, brain ketone and glucose metabolism were quantified by positron emission tomography (primary outcome), and cognitive performance assessed (secondary outcome). Plasma ketones were assessed every 30 min after kMCT or placebo during an 8-hour metabolic study day at baseline and at the end of the intervention. Results: Brain ketone metabolism increased by 230% on the kMCT ($p<0.001$) while brain glucose uptake remained unchanged. Measures of episodic memory, language, executive function and processing speed improved on the kMCT versus baseline. Increased brain ketone uptake was significantly positively related to change in several cognitive measures. 75% of participants completed the intervention (n=19 on kMCT, n=20 on placebo). Plasma ketone response to kMCT (n=10) or placebo (n=12) was unchanged after 6 months compared to baseline. Conclusion: 30 g/day of kMCT taken for six months bypasses a significant part of the brain glucose deficit and improves several cognitive outcomes in MCI. Acknowledgements: Financial support from the Alzheimer Association USA, FRQS, Université de Sherbrooke and Mitacs.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4218) Assessing the Turnover of Brain DHA with Tracer-free Natural Abundance Carbon Isotope Ratio Analysis

Presenting Author: Richard P. Bazinet - University of Toronto

The brain is highly enriched in the long-chain omega-3 (n-3) PUFA DHA. Due to the limited capacity for local DHA synthesis in the brain, it relies on a continual supply from the circulation

to replenish metabolized DHA. Previous studies investigating brain DHA turnover and metabolism have relied on isotope tracers to determine brain fatty acid kinetics; however, this approach is cumbersome and costly. We applied natural abundance carbon isotope ratio analysis via high-precision gas chromatography combustion isotope ratio mass spectrometry, without the use of labeled tracers, to determine the half-life of brain DHA in mice following a dietary switch experiment. Mice fed diets containing either α-linolenic acid (ALA) or DHA as the sole dietary n-3 PUFA were switched onto diets containing ALA, DHA, or ALA + DHA at 6 weeks of age, while control mice were maintained on their respective background diet. We measured brain DHA carbon isotope ratios (reported as δ13CDHA signatures) over a 168-day time course. Brain δ13CDHA signatures of control mice maintained on background diets over the time course were stable ($P > 0.05$). Brain δ13CDHA signatures of mice switched to the DHA or ALA + DHA diet from the ALA diet changed over time, yielding brain incorporation half-lives of 40 and 34 days, respectively. These half-lives determined by natural abundance carbon isotope ratio analysis were consistent with estimates from kinetic isotope tracer studies. Our results demonstrate the feasibility of natural abundance carbon isotope ratio analysis in the study of fatty acid metabolism without the use of isotopically labeled fatty acid tracers.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition

(4219) Deciphering the Various Plasma Pools that Supply the Brain with DHA: Insight from Studies in Rats

Presenting Author: Raphael Chouinard-Watkins - University of Toronto

Docosahexaenoic acid (DHA, 22:6n-3) is crucial for optimal neuronal development and function. The brain has a poor capacity to synthesise DHA and it is believed that the plasma primarily supplies the brain with DHA. Our group and others have shown that there are two major plasma pools that supply brain DHA: lysophosphatidylcholine containing DHA (lysoPtdCho-DHA) and nonesterified DHA (NE-DHA). However, brain compartmentalisation of these two forms and whether feeding different DHA carriers leads to differential brain uptake is unclear. By using radiotracers, we first showed that lysoPtdCho-DHA is selectively partitioned to specific phospholipids in the brain upon steady state i.v infusion when compared to NE-DHA, supporting the hypothesis that these two DHA forms are taken up differently by the brain. Because of its longer plasma half-life, brain radioactivity after lysoPtdCho-DHA infusion was also higher than after NE-DHA infusion. In the next experiment, we gavaged different DHA radiotracers, including derivatives of lysoPtdCho-DHA and NE-DHA, to assess brain uptake acutely. We found that phosphatidylcholine containing DHA (PtdCho-DHA), a precursor to lysoPtdCho-DHA, was more efficient at targeting the brain than triacylglycerol containing DHA and this was potentially explained by lysoPtdCho-DHA formation. We also showed that phosphatidylserine containing DHA was as efficient as PtdCho-DHA for targeting the brain after gavage, but the mechanisms by which this occurred remain unknown. Future studies will test whether chronic

feeding with various synthetic DHA carriers lead to differential brain enrichment. These results will provide a better understanding of the mechanisms by which DHA reaches the brain.

Monday, June 29, 2020

Session Time: 10:25 AM - 12:45 PM

Presentation Time: 11:20 AM - 11:45 AM

Track: Health and Nutrition@@@Analytical

(3482) Analysis of the Antitumor Activity of Bioactive Compounds of Cannabis Flowers Extracted by Green Solvents

Presenting Author: Ignacio Vieitez Osorio, pHD - PEDECIBA Quimica-UdelaR

Specific substances of the genus Cannabis, called cannabinoids, have aroused great interest from the international community due to their pharmacological and medicinal potential, such as significant antitumor activities. Cannabinoids are found at high concentrations in the flowers of non-pollinated female plants. The most studied bioactive substances are cannabidiol (CBD) and delta-9-tetrahydrocannabinol (delta9-THC). The inhibitory effects of Cannabis flower extracts, obtained by supercritical carbon dioxide (scCO2) with and without modifier, on various human tumour cells and non-tumour cells were evaluated. Different techniques were used to optimize the polarity interaction between solute and solvent before extraction. An increase in the cannabinoid content of interest (CBD/THC) was evaluated by decarboxylation of the flowers at 110 and 140 °C. Extractions with pure scCO2 were conducted in a single step at temperatures of 50 and 70 °C and pressures of 22 and 40 MPa, varying the time of prior decarboxylation by 0.5 or 2.0 hours. Sequential extractions were conducted in a first step at 35 °C and 10 MPa and then in a second step at 70 °C and 40 MPa, with and without modifier. Contents of the cannabinoids were evaluated using HPLC. Antitumor activity of the extracts was evaluated using the MTT assay. The highest yields and highest cannabinoid contents in the extracts were obtained with high solvent density values. Extracts with high concentrations of neutral cannabinoids showed high antitumor activity for cervical cancer cell lines.

Wednesday, July 1, 2020

Session Time: 8:25 AM - 11:20 AM

Presentation Time: 8:55 AM - 9:20 AM

Track: Health and Nutrition@@@Analytical

(3602) Varietal Differences in Carotenoid Composition and Their Bioaccessibility from Papaya (C. papaya) Cultivars in Hawaii

Presenting Author: Alice Laurora, MSc - University of Hawaii/University of Copenhagen

Papaya (C. papaya) is a rich source of bioactive compounds, however their content varies greatly depending on factors such as the variety and growing location. In this study, three yellow-fleshed

papaya cultivars (Laie Gold, Rainbow, Kapoho Solo) and two red-fleshed cultivars (Sunset and Sunrise) were harvested from different locations throughout the Islands of Hawaii and analyzed for their mineral and carotenoid content using ICP-MS and HPLC, respectively. Bioaccessibility of carotenoids across papaya cultivars were compared using an in-vitro digestion model. Yellow-fleshed papayas contained two major carotenoids, including β-carotene and β-cryptoxanthin. In addition to these two carotenoids, red-fleshed papayas also contained high lycopene levels. Varietal and geographical differences were evident in both carotenoid content and their bioaccessibility. β-Cryptoxanthin was the main carotenoid among yellow-fleshed cultivars Laie Gold, Rainbow and Kapoho Solo (242.9-739.5 µg/100 g), followed by β-carotene (152.4-331.0 µg/100 g). The red-fleshed varieties Sunset and Sunrise contained 1089.6-1570.4 µg lycopene /100 g. Papayas (1 cup; 140 g) contained 6 % and 8 % of the dietary reference intake (DRI) for Cu and Mg, respectively, but less than 3% of the DRI for other minerals. The highest bioaccessibility across all varieties was found for β-carotene (1.7 % to 20.5 %), followed by β-cryptoxanthin (1.1 % to 11.7 %). Among yellow-fleshed papayas total carotenoid bioaccessibility was highest in the Rainbow variety from Kea'au and Kapoho farms. Bioaccessibility of lycopene from red-fleshed papayas ranged from 1.5 to 11.4 %. Altogether, these findings suggest that not only variety, but also different growing location alter the content and bioaccessibility of carotenoids in papaya.

Wednesday, July 1, 2020
Session Time: 8:25 AM - 11:20 AM

Presentation Time: 10:30 AM - 10:30 AM

Track: Health and Nutrition@@@Analytical

(4045) Butyric acid concentration is associated with Firmicutes bacteria abundance after dairy intake among hyperinsulinemic individuals

Presenting Author: Leila Khorraminezhad, PhD student - Endocrinology and Nephrology Unit, CHU de Québec-Laval University Research Center, Québec (QC), Canada

Objective/hypothesis: To investigate the association between short-chain fatty acids (SCFA) and gut microbiota after consumption of a high-dairy compared to an adequate-dairy intake among individuals with hyperinsulinemia. Methods: Participants were randomized in a two-phase crossover study according to high-dairy (≥4 servings/day (Canada's Food Guide for Healthy Eating (2007)) or adequate-dairy intake (≤2 servings/day) for 6 weeks. SCFA concentrations were measured in stool samples by headspace gas chromatography-mass spectrometry using a HP-Innowax column. Gut microbiome was measured by high-throughput sequencing of the 16S-rRNA gene fragments. Paired-T test and machine learning (ML) analyses were performed on the data. Results: Ten individuals with hyperinsulinemia were included in this study (mean± SD: BMI 31.9 ±2.9 kg/m2; age 58 ±13 years). Gut microbiome composition did not change significantly between high- and adequate-dairy intakes; however, the abundance of Firmicutes was positively correlated to insulin sensitivity. Results showed that SCFA including acetic acid (162 ±134 versus 132±170 mmol/kg), propionic acid (11±6 versus 8±4 mmol/kg) and butyric acid (9 ±4 versus 9±6 mmol/kg) did not change after high-dairy compared to adequate intake,

respectively. ML analysis (which included age, sex, and BMI as features before feature selection) found that butyric acid concentration can be predicted by the abundance of Firmicutes phylum bacteria including Clostridium-sensu, Turicibacter, Romboutsia, Tyzzerella, Lachnospiracea, Incertae-sedis, and Faecalitalea. Conclusion: Results showed that butyric acid concentration could be linked to the abundance of Firmicutes bacteria which may modify insulin sensitivity in hyperinsulinemic individuals. Registration number: NCT02961179. (Financial support: Canadian Institutes for Health Research).

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Analytical

(3927) Identification, Purification, and Anti-obesity Effects of 4,4-dimethyl Phytosterols in Different Vegetable Oils.

Presenting Author: Tao Zhang - Jiangnan University

4,4-Dimethylsterols, a special class of naturally-occurring phytosterols, possess numerous health benefits via ameliorating the endogenous cannabinoid system. In this study, the 4,4-dimethylsterols in 31 vegetable oils were identified and compared. Our results for the first time revealed a complementary distribution in shea nut butter and rice bran oil. Preparative chromatography was then utilized for purification of the two classes of 4,4-dimethylsterols. We found that 4,4-dimethylsterols in rice bran oil promoted fat loss in Caenorhabditis elegans fed with 50 mmol/L glucose. Additionally, we explored the anti-obesity effects of 4,4-dimethylsterols in a diet-induced obesity mice model. The supplementation with 4,4-dimethylsterols significantly reduced body weight gain and prevented white adipose tissue accumulation, Therefore, we conclude that the 4,4-dimethylsterols could be considered to treat or prevent obesity-related disorders.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Analytical

(4062) Effects of Conjugated and Polyunsaturated Fatty Acids on Lifespan and Healthspan in Caenorhabditis elegans

Presenting Author: Mengyue Gong - Jiangnan University

Conjugated and polyunsaturated fatty acids have demonstrated various health-benefit effects on experimental animals and human beings. However, the results are not always consistent. Caenorhabditis elegans is a simplified model to identify and study of the effect and mechanism of conjugated and unsaturated fatty acids compounds on fat storage, lifespan, progeny and other

parameters in a living organism, benefit from its small size, short lifespan, easy maintenance, and completely sequenced genome. Therefore in this study, the worm size, lifespan, fat accumulation, progeny numbers, and hatchability were studies using selected conjugated and unsaturated fatty acids containing oils. The results indicated that flaxseed oil may process similar effect as compared to conjugated linoleic acid, while different from conjugated linolenic acids.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Analytical

(3665) Metabolomics reveals the toxicological effects of polar compounds from frying palm oil

Presenting Author: YongJiang Xu - Jiangnan University

Polar compounds (PCs) from frying oil have been regarded to be harmful to health. However, the mechanisms underlying this phenomenon have largely remained elusive. In this study, mass spectrometry (MS)-based metabolomics was used to investigate the toxicological effects of PCs. Serum and hepatic metabolites from PCs treated mice were measured using liquid chromatography–MS and gas chromatography–MS, and multi-variate statistical analysis. A series of 37 serum metabolites and 18 hepatic metabolites were found to be altered in PCs treated mics as compared with normal diet-fed animals. These metabolic changes suggested novel alterations of lipid metabolism, with increase of phospholipids, fatty acid, cholesterol and decrease of choline, betaine, acyl-carnitine and succinate. The carbohydrate, amino acid and nucleotide metabolism was affected with significant elevation of glucose, lactose, maltose, branched chain amino acid and uric acid and decline of serine, aspartate, arginine and ornithine. Pearson correlation analysis uncovered strong associations between specific metabolic alterations and redox index of serum and liver. Our overall finding reveals PCs could progressively cause lipid deposition, impaired glucose tolerance and oxidative stress, resulting in toxicological effects on mammal health.

Tuesday, June 30, 2020

Session Time: 10:25 AM - 12:35 PM

Presentation Time: 10:55 AM - 11:20 AM

Track: Health and Nutrition@@@Edible Applications Technology

(3515) Impact of Nanochitin on Gastrointestinal Fate of Pickering Emulsions: Lipid Digestion and Nutraceutical Bioavailability

Presenting Author: Hualu Zhou, PhD - University of Massachusetts Amherst

Objective Chitin is an abundant and sustainable biomaterial with potential applications in foods and other commercial products. At present, there is a poor understanding of the formation and stabilization mechanisms of nanochitin-coated oil droplets, as well as about the impact of the adsorbed nanochitin particles on lipid digestion and nutraceutical bioavailability under gastrointestinal conditions. Methods The formation, stability, and performance of nanochitin-stabilized Pickering emulsions were compared to conventional surfactant-stabilized emulsions. Tween 20, a widely used food-grade non-ionic surfactant was used a model surfactant. Lipid digestion was followed by monitoring the amount of free fatty acid (FFAs) released within the simulated small intestine and nutraceutical bioaccessibility was followed by measuring the amount of nutraceutical solubilized within the mixed micelles. Results The nanochitin-coated oil droplets behaved very differently from the surfactant-coated ones under simulated gastrointestinal conditions. In particular, there was a decrease in lipid digestion of around 30% in the presence of 0.1 wt% nanochitin. This effect was attributed to a number of physicochemical mechanisms: (1) nanochitin promoted droplet flocculation, which reduced the lipid surface area available for the bile salts and lipase to adsorb; (2) the cationic nanochitin may have directly interacted with anionic bile salts, free fatty acids, and lipase, which inhibited lipid digestion and reduced nutraceutical bioaccessibility. Conclusions Nanochitin can be used as a food-grade particle stabilizer in oil-in-water emulsions that inhibits lipid digestion, which may be useful for developing high-satiety foods. However, one must be careful that it does not always inhibit the bioaccessibility of hydrophobic bioactive agents, such as nutraceuticals and oil-soluble vitamins.

Tuesday, June 30, 2020

Session Time: 10:25 AM - 12:35 PM

Presentation Time: 12:10 PM - 12:35 PM

Track: Health and Nutrition@@@Edible Applications Technology

(3770) Milk Polar Lipid Supplementation Improves Cholesterol Metabolism in Postmenopausal Women: Gut-Related Mechanisms

Presenting Author: Marie-Caroline Michalski, PhD, Eng. - Inserm U1060, INRAE UMR1397, UCB Lyon 1

Objective/Hypothesis: Nutritional strategies are relevant to manage CVD risk in postmenopausal women. Preclinical studies reported benefits on cholesterolemia of milk polar lipids (MPL), but effects in humans remained to be clarified. We hypothesized that MPL could improve cholesterol

metabolism by modifying cholesterol absorption and fate in the gut. Methods Used: In a double-blind randomized controlled trial, 58 postmenopausal women with fasting HDL-cholesterol<1.6 mM were subjected to a 4-week dietary intervention with daily consumption of a cream-cheese containing 12g of milkfat including either 0g (control, n=19), 3g (n=19) or 5g (n=20) of MPL (among which 0.8 or 1.2g of sphingomyelin). Before/after intervention, blood lipids were measured; fecal lipids were analyzed in a subgroup. A proof-of-concept mechanistic crossover study was performed in 4 ileostomized subjects (8h-postprandial tests after consuming the experimental cheeses labelled with 2H-cholesterol). Results: Milkfat enriched with MPL induced dose-response reductions in serum total cholesterol (-6.8% in 5g group, $p<0.05$), LDL-cholesterol (-8.7%, $p<0.05$) and HDL/total-cholesterol ratio ($p<0.001$), compared to the control that had no effect. MPL supplementations increased fecal coprostanol excretion ($p<0.05$). The fecal coprostanol/cholesterol ratio was inversely correlated with LDL-cholesterol after intervention ($r=-0.5$, $p<0.05$). 2H-cholesterol content in postprandial plasma and chylomicrons of ileostomized subjects was reduced after MPL-cheeses ($p<0.05$ vs control). Cholesterol and milk sphingomyelin increased in ileal efflux after MPL-cheeses ($p<0.05$). Conclusions: A dietary strategy based on lipid quality, including MPL, can contribute to improve the cardiometabolic health of postmenopausal women. This can be via cholesterol fate in the gut, through interactions with sphingomyelin and conversion to coprostanol.

Wednesday, July 1, 2020
Session Time: 8:25 AM - 11:20 AM

Presentation Time: 9:20 AM - 9:45 AM

Track: Health and Nutrition@@@Edible Applications Technology

(3660) Mimicking Lipid Self-assembly in Digesting Milk-like Emulsions

Presenting Author: Andrew Clulow, MChem, PhD - Monash Institute of Pharmaceutical Sciences

Hypothesis & Objective: Milk is nature's emulsion for delivering fats and fat-soluble nutrients to infants. Intestinal lipolysis of milk triglycerides yields fatty acids and monoglycerides that spontaneously assemble into different liquid crystalline phases depending on species. It was hypothesized that specific liquid crystalline phases are advantageous for nutrient absorption by different species and that controlling liquid crystalline structure formation is key to nutrient delivery. A key issue in testing this hypothesis is the chemical complexity of milk fats, making the analysis of the individual lipid components challenging. The objective of this work was therefore to design simplified triglyceride mixtures that mimic the liquid crystalline phase progressions occurring during milk lipid digestion for use in representative intestinal colloid mimics. Methods: Simulated intestinal digestions were performed *in vitro* using the pH-stat technique. Synchrotron small angle X-ray scattering with *in situ* lipolysis was used to reveal the self-assembly of amphiphilic digestion products generated during digestion of triglyceride emulsions. Results: The progression of liquid crystalline phases formed during the digestion of bovine and human milk were compared with commercial infant formulas. The liquid crystalline phases formed by digesting human milk were dependent on processing but those of bovine milk

were not. In most cases infant formula did not mimic human milk. Triglyceride emulsions comprising homotriglycerides were prepared and the simplest emulsions required to mimic milk digestion behaviour were identified. Conclusion: The progression of liquid crystalline phases observed in digesting bovine and human milk can be mimicked using simplified homotriglyceride mixtures.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Edible Applications Technology

(3600) Acute Lipemic Response Differences Based on Emulsion Triacylglycerol Physical State

Presenting Author: Amanda J. Wright, PhD - University of Guelph

The role of dietary triacylglycerol (TAG) physical properties in determining metabolic response is a matter of renewed interest in the context of aiming to clarify the contributions of fatty acid species to health and disease. Integrated in vitro gastrointestinal digestion – postprandial human experiments are rare, but can offer unique insights and help to elucidate the mechanisms involved. We recently showed that compositionally equivalent tempered palm stearin emulsion droplets containing partially crystalline TAG had delayed plasma lipemic response compared to undercooled liquid droplets, when consumed by healthy adult men. Additionally, there were differences in satiety hormone induction between the emulsions. Corresponding static in vitro digestion experiments support that the human study results were related both to droplet physical (i.e. liquid versus solid) and colloidal (i.e. gastric acid-stable versus -unstable) properties. Combined, the findings confirm that, all other things being equal, the presence of TAG crystallinity modulates postprandial lipemia which is an independent risk factor for cardiovascular disease. The interactions observed between TAG physical and colloidal state are being further explored using high-resolution ultrasound imaging to compare gastric emptying between palm stearin- and palm olein-based emulsions produced with acid-stable and –unstable emulsifiers, in relation to emulsion physicochemical properties and acute satiety and lipemic response. Both qualitative and quantitative differences are observed, visually, by ultrasound. The results underscore that TAG physical state and supramolecular structure can have wide-ranging possible impacts on metabolic response, based on their influence on digestive processing.

Friday, January 1, 2021

Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Industrial Oil Products

(3488) Impact of Curcumin Delivery System Format on Bioaccessibility: Nanocrystals, Nanoemulsion Droplets and Natural Oil Bodies

Presenting Author: Bingjing Zheng, Ph.D candidate - Food Biopolymer and colloid Lab

The hydrophobic nutraceutical, curcumin, is claimed to exhibit a broad range of biological activities. Its application in functional foods and beverages is often limited by its relatively low solubility in aqueous media, its chemical instability, and its low bioavailability. We introduced an innovative and simple techinic, pH-shifting method, to incorporating the polyphenol-based nutraceutical in to designed and already existing colloidal systems, including curcumin nanocrystals; curcumin-loaded nanoemulsions; and curcumin-loaded soy oil bodies. The control simply consisted of curcumin powder dispersed in water. The nanoemulsions and oil bodies formed yellowish creamy dispersions that were stable to creaming, whereas the nanocrystals formed a cloudy yellow-orange suspension that was prone to sedimentation. The potential gastrointestinal fate of the different delivery systems was assessed using static in vitro digestion model that consisted of mouth, stomach, and small intestine phases. The nanoemulsions and oil bodies were rapidly and fully digested, while the nanocrystals were not. All three systems were relatively stable to chemical transformation in the in vitro digestion model, but the nanocrystals gave a low bioaccessibility, whereas the other two systems had a high bioaccessibility, which was attributed to their ability to form mixed micelles to solubilize the curcumin. These results have important implications for the creation of more effective delivery systems for curcumin.

Wednesday, July 1, 2020

Session Time: 8:25 AM - 11:20 AM

Presentation Time: 8:30 AM - 8:30 AM

Track: Health and Nutrition@@@Lipid Oxidation and Quality

(3510) A Qualitative Approach for Enhancing the Nutritional Properties of Palm Olein and Flaxseed Oil

Presenting Author: Kshitij Bhardwaj, Dr - King georges medical university

Palm olein oil is known for its stability but has limitation in the health and nutrition industry as it is high in saturated fats. Flaxseed oil is known for various health benefits and only high Omega 3 Plant-Based source. Oxidation of flaxseed oil limits its utilization on commercial Basis. Present work is carried out to make a unique blend of flaxseed and palm olein oil which has a high smoke point, stability and have balance ratio of omega 3, 6 and 9 as a single oil medium. Method Flaxseed oil was blended with Palm olein oil in the stabilized ratio of 3:4. Smoke point and shelf-life (oxidation stability) of pure oils fatty acid profile of raw oil and blended oil were evaluated. Results: oxidation stability Index of pure oils were 72 for palm oil and only 6 for

flaxseed oil and 38.68 for Flaxseed and palm oil blend at 100 Â°C which is improved by 32.68 % , Smoke point of pure palm olein (320) and flaxseed oil (135) as compared to Blended flax and palm oil (248) , Induction period after 1 month storage 42(PO), 3.35 (FO) 28.17 (FOB). Conclusion: Blending flaxseed oil with Palm olein oil in a proper ratio is a novel alternative to increase the commercial productivity of both the oils in terms of quality and oxidative stability which make this blend nutritionally rich and provide the recommended amount of omega 3, omega 6 and omega 9.

Wednesday, July 1, 2020
Session Time: 8:25 AM - 11:20 AM

Presentation Time: 10:55 AM - 10:55 AM

Track: Health and Nutrition@@@Lipid Oxidation and Quality

(4096) Implications of short-term high-fat intake on gut, liver, and cardiovascular health of adolescent male rats

Presenting Author: Karen L. Sweazea, PhD, FAHA - Arizona State University

Chronic intake of energy-dense foods is known to alter gut microbial diversity and promote liver disease in adults, which may contribute to the development of cardiovascular and neurological disease. However, the effects of short-term high-fat intake are less known in adolescents. We hypothesized that high-fat intake for 6 weeks would promote intestinal dysbiosis, hepatic lipid infiltration, and impaired cardiovascular function in six-week old male Sprague-Dawley rats. Rats were divided into two groups and fed either a standard rodent chow or a 60% high-fat diet (HFD) for 6 weeks. Chromogenic endotoxin quantification assays indicate an increase in lipopolysaccharide concentration in the plasma of HFD rats ($p = 0.032$). Additionally, Western blot analyses of the cecum showed significantly greater protein expression of the transcription factor, nuclear factor kappa B (NF-kB), ($p = 0.037$) and the proinflammatory cytokine, interleukin-1β (IL-1β), ($p = 0.042$) in rats fed HFD. Linear discriminate analysis of effect size (LEfSe) showed greater abundance of Firmicutes and Actinobacteria in samples collected from the cecum of HFD rats compared to chow. In addition, Oil red O staining of liver samples from HFD rats showed evidence of hepatic steatosis and increased circulating alanine aminotransferase, a marker of liver injury ($p < 0.001$). With respect to cardiovascular health, HFD-fed animals develop impaired vasodilation resulting from inflammation and oxidative stress. These findings show that a short-term high-fat diet can have profound deleterious effects on gastrointestinal health and the inflammatory state of young male Sprague–Dawley rats.

Tuesday, June 30, 2020

Session Time: 10:25 AM - 12:35 PM

Presentation Time: 11:20 AM - 11:45 AM

Track: Health and Nutrition@@@Phospholipid

(3523) Tumoral Docosahexaenoic Acid Content of 5% Improved Chemotherapy Efficacy in Mice Bearing Patient Derived Breast Cancer Xenografts Via the Necroptosis Pathway

Presenting Author: Marnie Newell - University of Alberta

Docosahexaenoic acid (DHA) enhances the action of relevant cytotoxic drugs and reduces the growth of immortalized breast cancer cell lines *in vitro* and *in vivo*. We sought to confirm this in a more clinically translatable heterogeneic model, using breast cancer patient derived xenografts (PDXs). Female NSG mice bearing triple negative breast cancer PDX tumors (100 mm3) were randomized to one of two nutritionally adequate high fat diets (20% w/w ± DHA). Treatment paradigms included a) control (0% dietary DHA); b) control+ docetaxel (TXT 5mg/kg; intraperitoneal) and c) 4% w/w of fat DHA+ TXT (n=7/group). After 6 weeks of chemotherapy, tumors were excised, weighed and the phospholipid fatty acid composition determined. Feeding 4% DHA decreased tumor growth by 43% and 34% compared to control or control+TXT, respectively ($P<0.05$) and increased tumor phospholipid DHA compared to control+TXT (5.7 ± 0.3% vs 3.8 ± 0.2%, $P<0.05$). We further sought to determine the mechanisms through which DHA elicits this anti-tumor effect. An increase in necrotic tissue was observed in immunohistochemical haematoxylin and eosin (H and E) staining of the DHA+TXT tumors compared to both control diet groups. Protein analysis confirmed a higher expression of proteins involved in necroptosis: Ripk1, Ripk3 and MLKL, coinciding with a lower NFκB protein expression in tumors from the DHA+TXT group ($P<0.05$). This study suggests, that feeding a diet supplemented with DHA facilitates the anti-cancer effect of TXT on breast cancer PDXs, at least in part, through increased necroptosis. (supported by CIHR)

Thursday, July 2, 2020

Session Time: 8:25 AM - 12:10 PM

Presentation Time: 9:45 AM - 10:10 AM

Track: Health and Nutrition@@@Phospholipid

(4174) Complex Lipid Coated Milk Fat: Its Biological Role in Early Life Programing for Later Life Health

Presenting Author: Sandra Einerhand, PhD - Einerhand Science & Innovation

Milk fat droplets are coated by triple-layer of membranes containing numerous complex lipids (CL) like phospholipids and sphingolipids. CL functions to protect the droplet from coalescence and degradation, thereby modulating release of triacylglycerol molecules. CLs have important functional roles in the body as well. Here the role of CL-coated milk fat in early life and its potential impact on later life health is highlighted. Several intervention studies in early life have been conducted suggesting that supplementation of infant and mama formulas with CL is safe. In

infants, CL supplements leads to improvements in cognition, fever incidence, and infectious outcomes including diarrhea and otitis media. Therefore, CL supplementation of infant formula may narrow the gap between breastfed and formula-fed infants. Furthermore, not only CLs matter, but also the size of the fat droplet matters. Large CL-coated fat droplets that mimic human milk prevented fat accumulation and improved the metabolic profile in adulthood in a preclinical model. Safety of this new concept has recently been demonstrated in infants and an efficacy study is currently ongoing. A proof-of-concept study in adults suggests that fats in an infant formula with larger and complex-coated fat droplets are more rapidly absorbed than those from a standard infant formula. These preliminary data suggest that exposure to a CL-coated milk fat structure in early life may be a key determinant of later life metabolic health.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Health and Nutrition@@@Phospholipid

(3768) Linoleate-rich cardiolipin and tissue architecture are altered in skeletal muscle of healthy mice fed diets differing in dietary fat quality

Presenting Author: Deena B. Snoke - The Ohio State University

Cardiolipin (CL) is a phospholipid integral to mitochondrial inner membrane structure and function in cardiac and skeletal muscle. Little is known about how diet influences CL in skeletal muscle, which may thereby affect muscle metabolism and function. We investigated how different dietary oils impacted CL species and muscle architecture in healthy C57 BL6/J mice fed AIN-93M diets containing 6%wt of palm (PO), linoleate-rich safflower (LO), or oleate-rich safflower (OO) oils for 5 weeks. Mice fed the LO diet exhibited a shift towards smaller muscle fiber cross-sectional area. Despite no changes in total CL, there was an increase in the percent of m/z 1448 (tetralineoyl-CL) in mice fed the LO diet VS the OO diet but not the PO diet. A loss of linoleate-containing CL species and an increase in oleate-containing species has an unfavorable impact on mitochondrial energetics. Mice consuming OO or PO diets displayed shifts towards oleate-containing CL species when compared to the LO diet group. Further, mice fed OO diet had greater relative amounts of oxidated and peroxidated CL species. Although citrate synthase activity between groups was similar, there was a significant positive relationship between citrate synthase activity and both m/z 1448 and total CL in only mice fed the LO diet. These findings indicate that in healthy mice, diet influences LA-rich CL that may impact skeletal muscle metabolism. Because skeletal muscle drives glucose disposal, it is important to further investigate these findings in the context of metabolic disease.