Quality of Popular Diet Patterns in The United States: Evaluating the Effect of Substitutions for Foods High in Added Sugar, Sodium, Saturated Fat and Refined Grains


**Significance:** National survey data shows that the overall quality of popular diet patterns vary greatly, and that all would benefit from a few simple food substitutions. This study examines the quality of popular diet patterns in the US and models the effect of targeted food substitutions on diet quality.

This study was supported by the IAFNS Carbohydrates Committee.

**Background:** Many Americans have adopted popular diet patterns for general health improvement that restrict specific foods, macronutrients, or eating time. However, there is limited evidence to characterize the quality of these diet patterns. **Objectives:** This study 1) evaluated the quality of popular diet patterns in the United States and 2) modeled the effect of targeted food substitutions on diet quality. **Methods:** Dietary data from 34,411 adults ≥20 y old were acquired from the NHANES, 2005–2018. Dietary intake was assessed using the National Cancer Institute's usual intake methodology, and the Healthy Eating Index-2015 was used to evaluate diet quality. A diet model was used to evaluate the effect of targeted food substitutions on diet quality. **Results:** A pescatarian diet pattern had the highest diet quality (65.2; 95% CI: 64.0, 66.4), followed by vegetarian (63.0; 95% CI: 62.0, 64.0), low-grain (62.0; 95% CI: 61.6, 62.4), restricted-carbohydrate (56.9; 95% CI: 56.6, 57.3), time-restricted (55.2; 95% CI: 54.8, 55.5), and high-protein (51.8; 95% CI: 51.0, 62.7) diet patterns. Modeled replacement of ≤3 daily servings of foods highest in added sugar, sodium, saturated fat, and refined grains with alternative foods led to an increase in diet quality and a decrease in energy intake for most diet patterns. **Conclusions:** Low diet quality was observed for all popular diet patterns evaluated in this study. Modeled dietary shifts that align with recommendations to choose foods lower in added sugar, sodium, saturated fat, and refined grains led to modest improvements in diet quality and larger reductions of energy intake. Greater efforts are needed to encourage the adoption of dietary patterns that emphasize consumption of a variety of high-quality food groups.

Reproducibility and Validity of the Toronto-Modified Harvard Food Frequency Questionnaire in a Multi-Ethnic Sample of Young Adults


**Significance:** A diet intake study in young Caucasian and East Asian adults found the validity of a Toronto-modified Harvard food frequency questionnaire (FFQ) was comparable to a three-day food record. Culturally diverse diets should be considered in future protocols.

**Background/Objectives:** To assess the reproducibility and validity of a Toronto-modified Harvard food frequency questionnaire (FFQ) among a multi-ethnic sample of young adults. **Subjects/Methods:** A total of 150 participants recruited from the Toronto Nutrigenomics and Health Study cohort who had existing dietary intakes assessed by FFQ (FFQ1) and reassessment one year later (FFQ2). Of these, 100 participants also completed a three-day food record to evaluate the validity of the FFQ for 38 nutrients (energy, 14 macronutrients, 22 micronutrients, and 1 bioactive).
Analyses were also stratified between the two major ethnic groups (Caucasian and East Asian). **Results:** Among the full sample, mean intakes of most nutrients (27/38) did not differ significantly between estimates derived from FFQ2 compared to the three-day food record. Energy, sex, and ethnicity adjusted deattenuated Pearson correlation coefficients ranged from 0.20 to 0.92 (mean r = 0.52 ± 0.15), and 34/38 validity coefficients were r ≥ 0.32. Gross misclassification of intakes between FFQ2 and the three-day food record was low (<6%), but energy, polyunsaturated fatty acids (PUFA), and sodium were underestimated by FFQ2. Mean intakes between FFQ1 and FFQ2 did not differ significantly for any nutrient. Between the two major ethnic groups, mean validity coefficients were similar, but varied for individual nutrients with saturated fat, PUFA, and omega 3 being among the most discrepant. **Conclusions:** Compared to a three-day food record, the Toronto-modified Harvard FFQ is a reproducible and valid tool to estimate dietary intake among a multi-ethnic sample of young adults. However, incorporation of protocols to improve the assessment of culturally diverse diets should be considered.

**Carbohydrates**

**Structural Elucidation Approaches in Carbohydrates: A Comprehensive Review on Techniques and Future Trends**

Yuning Liu, Yajun Huang, Ruiyu Zhu, Mohamed A Farag, Esra Capanoglu, Chao Zhao. *Food Chem.* 2022, Epub Sept. 6, 30;400:134118. doi: 10.1016/j.foodchem.2022.134118. [Article link](iafns.org)

**Significance:** This review provides current and advanced analytical tools for assessment of pharmacological and dietary impacts, in addition to recognizing the limitations of existing technologies.

Carbohydrates and their implications for human health have been the subject to a rapidly growing interest. Substantial dietary impacts, in addition to recognizing the limitations of existing technologies. Developing a carbohydrate profile technology would surely aid the understanding of carbohydrate dietary impacts. With advances in technology for characterization, as well as exploration of complex structure, it is becoming more feasible to synthesize such compounds, rather than isolation. Several technological developments, including improved analytical tools, glycomics, and automation technology, have opened up new opportunities to globally assess most carbohydrates in envisioned samples. The main analytical methods applied to carbohydrates are described. And then the development of automation technology in glycan synthesis are introduced. This review concludes by considering the limitations of the existing technologies and required future developments for overcoming these limitations and improving identification score and/or yield.

**Protein**

**Dairy Food Intake is Not Associated with Frailty in Adults from the Framingham Heart Study**


**Significance:** The association between dairy foods and frailty remains inconclusive. The study found yogurt intakes were modestly associated with reduced frailty onset, while high-fat dairy intakes had a borderline association.

**Background:** Nutrients including protein, calcium, and fat may be associated with risk of frailty, yet specific contributions from whole dairy foods rich in these nutrients remain understudied. **Objective:** To determine associations between dairy intake [milk, yogurt, cheese, total (milk+yogurt+cheese), low-fat, and high-fat dairy, servings/week] and frailty onset and frailty phenotype components. **Design:** Prospective cohort study. All dairy intake exposures (servings/week) were assessed via a food frequency questionnaire (FFQ). **Participants/Setting:** Participants (aged 33–86 years) from the Framingham Offspring Study who were not frail at baseline (1998–2001), completed a FFQ and had 1 or 2 follow-up frailty assessments (2005–2008, 2011–14) were included. **Main Outcome Measures:** Frailty was defined as the presence of ≥3 Fried frailty phenotype components: unintentional weight-loss, exhaustion, slowness (gait speed), weakness (grip strength), and low physical activity. Individuals with 0–2 components were considered non-frail. **Statistical Analyses Performed:** Repeated measures logistic regression estimated odds ratios (OR) and 95% confidence intervals (CI) for frailty onset. Logistic (exhaustion and weight loss) and linear regression (gait speed, grip strength, and physical activity) estimated the association between baseline dairy intake and each frailty component at follow-up, adjusting for baseline values for age, sex, energy intake (residual analysis), current smoking, and multivitamin use. Models were further adjusted for health status in a secondary analysis. **Results:** Mean baseline age (±SD) was 61 years (±9, range 33–87), and 54% were female. Of 2,550 non-frail individuals at baseline, 8.8% (2005–2008) and 13.5% (2011–2014) became frail. Higher yogurt intake was associated with decreased odds of frailty [OR = 0.96 (95% CI: 0.93–0.99), p = 0.02]. Each additional serving of yogurt [β (SE): 0.004 (0.001), p < 0.01] and low-fat dairy [β (SE): 0.001 (0.0006), p = 0.04] was associated with significantly faster follow-up gait speed. Dietary intakes were modestly associated with reduced frailty onset, while high-fat dairy intakes had a borderline association.
intakes of high-fat dairy were associated with increased odds of frailty \( \text{OR} = 1.02 \) (95\% CI: 1.00-1.04), \( p = 0.05 \), but the \( p \)-value was of borderline significance. No associations were observed for other dairy foods. After adjusting for health status, the associations of high-fat dairy and yogurt with frailty became non-significant, although the magnitudes of the associations did not change. The association between yogurt and gait speed decreased in magnitude after adjusting for health status \( \beta \) (SE): 0.002 (0.001), \( p = 0.01 \). **Conclusion:** Dietary intakes of yogurt were modestly associated with reduced frailty onset and dietary intakes of high-fat dairy had a borderline association with increased odds of frailty, but other dairy food intakes showed no association in this study of healthy adults. Some dairy food intakes were modestly associated with follow-up gait speed. However, effect sizes were small, and the clinical importance of these associations remains undetermined.

**Low- and No-Calorie Sweeteners**

The Combined Effects of Aspartame and Acesulfame-K Blends on Appetite: A Systematic Review and Meta-Analysis of Randomized Clinical Trials


**Significance:** This systematic and meta-analysis of randomized trials found that non-nutritive sweetener intake can lead to a reduction in energy intake compared with caloric (sugar) or noncaloric (water) intake. However, it was inconclusive whether energy intake reduction was linked to subjective appetite ratings or incretin hormones.

Aspartame (Asp) and acesulfame-K (Ace-K) are nonnutritive sweeteners (NNSs) commonly used in combination to replace added sugars in reduced- or low-calorie foods and beverages. Despite Asp/Ace-K blends having negligible calories, their effects on appetite have not been reviewed systematically. We therefore undertook a systematic review and meta-analysis of the metabolic effects of Asp/Ace-K blends on energy intake (EI), subjective appetite scores, blood glucose, and the incretin hormones glucose-dependent insulinotropic peptide and glucagon-like peptide. MEDLINE, Web of Science, and Cochrane CENTRAL databases (Embase, PubMed, and CINAHL) were searched (May 2021) for randomized controlled trials (RCTs). Human RCTs using Asp/Ace-K blends compared with sugar and water controls were included, whereas isolated cell and animal studies were excluded. An overall 4829 publications were identified and 8 studies, including 274 participants, were retrieved for review. The Asp/Ace-K group’s EI was significantly reduced compared with sugar [mean difference (MD): -196.56 kcal/meal; 95\% CI: -332.01, -61.11 kcal/meal; \( p = 0.004 \)] and water (MD: -213.42 kcal/meal; 95\% CI: -345.4, -81.44 kcal/meal; \( p = 0.002 \)). Meta-analysis of subjective appetite scores and incretins could not be undertaken due to inconsistencies in data reporting and insufficient data, respectively, but of the 4 studies identified, no differences were observed between Asp/Ace-K blends and controls. The Asp/Ace-K group’s blood glucose was nonsignificantly reduced compared with sugar (MD: -1.48 mmol/L; 95\% CI: -3.26, 0.3 mmol/L; \( p = 0.1 \)) and water (MD: -0.08 mmol/L; 95\% CI: -0.62, 0.47 mmol/L; \( p = 0.78 \)). Lower EI in participants who were predominantly healthy and assigned to Asp/Ace-K blends could not be reliably attributed to changes in subjective appetite scores. Blood glucose and incretins were also generally not affected by Asp/Ace-K blends when compared with controls. Additional short- and long-term RCTs using NNSs and sugars at dietarily relevant levels are needed.

**Cognitive Health**

Serum ω-3 Fatty Acids and Cognitive Domains in Community-Dwelling Older Adults from the Nu-Age Study: Exploring the Associations with Other Fatty Acids and Sex


**Significance:** A study of 386 healthy older adults from a long-term Quebec cohort found that higher serum n-3 PUFA levels were associated with better nonverbal memory and processing speed in models not including other long-chain fatty acids.

**Background:** Omega-3 (n-3) PUFAs are suggested to play a role in the prevention of cognitive decline. The evidence may be inconsistent due to methodologic issues, including interrelations with other long-chain (14 or more carbons) fatty acids (LCFAs) and use of sex as a confounding factor rather than an effect modifier. **Objectives:** This study evaluated the association between serum n-3 PUFAs and performance across 4 cognitive domains, overall and by sex, while controlling for other LCFAs. **Methods:** In total, 386 healthy older adults (aged 77.4 ± 3.8 y; 53\% females) from the Quebec Longitudinal Study on Nutrition and Successful Aging underwent a cognitive evaluation and blood sampling. Verbal and nonverbal episodic memory, executive functioning, and processing speed were evaluated. Serum LCFA concentrations were measured by gas chromatography. LCFAs were grouped according to standard fatty acid classes and factor analysis using principal component analysis (FA-PCA). Multivariate linear regression models were performed,
including unadjusted and adjusted models for other LCFAs. **Results:** Higher n-3 PUFA concentrations were associated with better nonverbal memory and processing speed in fully adjusted models not including other LCFAs (βs of 0.21 and 0.19, respectively). The magnitude of these associations varied when other LCFAs were entered in the model (βs of 0.27 and 0.32, respectively) or when FA-PCA factors were considered (βs of 0.27 and 0.21, respectively). Associations with verbal episodic memory were limited to higher concentrations of EPA, whereas there was no association between n-3 PUFAs and executive functioning. Higher n-3 PUFAs were associated with better verbal and nonverbal episodic memory in females and with better executive functioning and processing speed in males. **Conclusions:** These results suggest that other LCFAs should be considered when evaluating the association between n-3 PUFAs and cognitive performance in healthy older adults. Sex differences across cognitive domains warrant further investigation.

**Lipids**

**Novel Lipid Emulsion for Total Parenteral Nutrition Based on 18-Carbon n-3 Fatty Acids Elicits a Superior Immunometabolic Phenotype in the Murine Model Compared to Standard Lipid Emulsions**


**Significance:** A novel lipid emulsion comprising of 18-carbon n-3 fatty acid was tested to have superior anti-inflammatory, insulin-sensitizing and immunity-enhancing properties compared to standard lipid emulsions for total parenteral nutrition feeding.

**Background:** While lipid emulsions in modern formulations for total parenteral nutrition (TPN) provide essential fatty acids and dense calories, they also promote inflammation and immunometabolic disruptions. **Objective:** We aimed to develop a novel lipid emulsion for TPN use with superior immunometabolic actions compared with available standard lipid emulsions. **Methods:** A novel lipid emulsion (Vegaven, VV) containing 30% of 18-carbon n-3 fatty acids (α-linolenic acid and stearidonic acid) was developed for TPN (VV-TPN) and compared with TPN containing soybean oil-based lipid emulsion (IL-TPN) and fish oil-based lipid emulsion (OV-TPN). In vivo studies were performed in instrumented male C57BL/6 mice subjected to seven-day TPN prior to analysis of cytokines, indices of whole body and hepatic glucose metabolism, immune cells, lipid mediators and mucosal bowel microbiome. **Results:** Interleukin-6 to interleukin-10 (IL10) ratios were significantly lower in liver and skeletal muscle of VV-TPN mice when compared with IL-TPN or OV-TPN. VV-TPN and OV-TPN each increased hepatic insulin receptor abundance and resulted in similar HOMA-IR (Homeostatic Model Assessment for Insulin Resistance) values, whereas only VV-TPN increased hepatic insulin receptor substrate 2 and maintained normal hepatic glycogen content, effects that were IL10-dependent and mediated by glucokinase activation. The percentages of interferon-γ- and interleukin-17-expressing CD4+ T-cells were increased in livers of VV-TPN mice, and liver macrophages exhibited primed phenotypes when compared with IL-TPN. This immunomodulation was associated with successful elimination of the microinvasive bacterium Akkermansia muciniphila from the bowel mucosa by VV-TPN as opposed to standard lipid emulsions. Assay of hepatic lipid mediators revealed a distinct profile with VV-TPN including increases in 9(S)-hydroxy-octadecatrienoic acid. When co-administered with IL-TPN, hydroxy-octadecatrienoic acids mimicked the VV-TPN immunometabolic phenotype. **Conclusions:** We here report the unique anti-inflammatory, insulin-sensitizing and immunity-enhancing properties of a newly developed lipid emulsion designed for TPN use based on 18-carbon n-3 fatty acids.

**Sodium**

**Effects of Salt Substitutes on Clinical Outcomes: A Systematic Review and Meta-Analysis**


**Significance:** This study found clear protective effects of salt substitute on total mortality, cardiovascular mortality and cardiovascular events.

**Objectives:** The Salt Substitute and Stroke Study (SSaSS) recently reported blood pressure-mediated benefits of a potassium-enriched salt substitute on cardiovascular outcomes and death. This study assessed the effects of salt substitutes on a breadth of outcomes to quantify the consistency of the findings and understand the likely generalizability of the SSaSS results. **Methods:** We searched PubMed, Embase and the Cochrane Library up to 31 August 2021. Parallel group, step-wedge or cluster randomized controlled trials reporting the effect of salt substitute on blood pressure or clinical outcomes were included. Meta-analyses and metaregressions were used to define the consistency of findings across trials, geographies and patient groups. **Results:** There were 21 trials and 31 949 participants included, with 19 reporting effects on blood pressure and 5 reporting effects on clinical outcomes. Overall reduction of systolic blood pressure (SBP) was −4.61 mm Hg (95% CI −6.07 to −3.14) and of diastolic blood pressure...
(DBP) was -1.61 mm Hg (95% CI -2.42 to -0.79). Reductions in blood pressure appeared to be consistent across geographical regions and population subgroups defined by age, sex, history of hypertension, body mass index, baseline blood pressure, baseline 24-hour urinary sodium and baseline 24-hour urinary potassium (all p homogeneity >0.05). Metaregression showed that each 10% lower proportion of sodium chloride in the salt substitute was associated with a -1.53 mm Hg (95% CI -3.02 to -0.03, p=0.045) greater reduction in SBP and a -0.95 mm Hg (95% CI -1.78 to -0.12, p=0.025) greater reduction in DBP. There were clear protective effects of salt substitute on total mortality (risk ratio (RR) 0.89, 95% CI 0.85 to 0.94), cardiovascular mortality (RR 0.87, 95% CI 0.81 to 0.94) and cardiovascular events (RR 0.89, 95% CI 0.85 to 0.94). **Conclusions:** The beneficial effects of salt substitutes on blood pressure across geographies and populations were consistent. Blood pressure-mediated protective effects on clinical outcomes are likely to be generalisable across population subgroups and to countries worldwide.

**Gut Microbiome**

**Herbs and Spices Modulate Gut Bacterial Composition in Adults at Risk for Cardiovascular Disease: Results of a Pre-Specified Exploratory Analysis from a Randomized, Crossover, Controlled-Feeding Study**


**Significance:** The incorporation of herbs and spices to an average American diet induced shifts in gut bacterial composition after 4-weeks in 54 adults at risk for cardiovascular disease. The metabolic significance of these changes warrant further study.

**Background:** Herbs and spices are rich in polyphenolic compounds that may influence gut bacterial composition. The effect of culinary doses of herbs and spices consumed as part of a well-defined dietary pattern on gut bacterial composition has not been previously studied. **Objectives:** The aim of this pre-specified exploratory analysis was to examine gut bacterial composition following an average American diet (carbohydrate: 50% kcal; protein: 17%; total fat: 33%; saturated fat: 11%) containing herbs and spices at 0.5 (Low Spice Diet; LSD), 3.3 (Moderate Spice Diet; MSD) and 6.6 (High Spice Diet; HSD) g.d-1.2100 kcal-1 in adults at-risk for cardiovascular disease (CVD). **Design:** Fifty-four adults (57% female; mean ± SD age 45 ± 11 years, BMI 29.8 ± 2.9 kg/m2; waist circumference 102.8 ± 7.1 cm) were included in this three-period, randomized, crossover, controlled-feeding study. Each diet was provided for 4-weeks with a minimum 2-week wash-out period. At baseline and the end of each diet period participants provided a fecal sample for 16S rRNA gene (V4 region) sequencing. QIIME2 was used for data filtration, sequence clustering, taxonomy assignment and statistical analysis. **Results:** Alpha diversity assessed by the Observed Features metric (p = 0.046) was significantly greater following the MSD vs. the LSD; no other between diet differences in alpha diversity were detected. Differences in beta-diversity were not observed between the diets (p = 0.45). Compared to baseline, beta-diversity differed following all diets (p < 0.02). Enrichment of the Ruminococcaceae family was observed following the HSD vs. the MSD (relative abundance (RA) = 22.14%; LDA = 4.22; p = 0.03) and the LSD (RA = 24.90%; LDA = 4.47; p = 0.004). **Conclusions:** The addition of herbs and spices to an average American diet induced shifts in gut bacterial composition after 4-weeks in adults at risk for CVD. The metabolic implications of these changes merit further investigation.

**Emerging Science Area**

**Category:** Nutrition and Health

**White House Strategy on Hunger, Nutrition and Health. Article link**

**Significance:** On Sept. 28, the White House convened a Conference on Hunger, Nutrition and Health where President Biden announced a goal of ending hunger and increasing healthy eating and physical activity by 2030 so fewer Americans experience diet-related diseases — while reducing related health disparities. Five strategies build on current existing government programs were announced.

The consequences of food insecurity and diet-related diseases are significant, far reaching, and disproportionately impact historically underserved communities. Yet, food insecurity and diet-related diseases are largely preventable, if we prioritize the health of the nation.

The Biden-Harris Administration envisions an America where no one wonders whether they will have enough money to put food on the table, where the healthy food choice is the easier choice, and where everyone has the same opportunity to be physically active. Transformative programs, policies, and system changes are needed within and outside government to achieve this vision. There is no silver bullet to address these complex issues, and there is no overnight fix. Making progress requires collective, sustained action and mobilization across every segment of society. That is why President Biden announced a goal of ending hunger and increasing healthy eating and physical activity by 2030 so fewer
Americans experience diet-related diseases — while reducing related health disparities. To advance the President’s goal—and build on the federal government’s existing work to address hunger and diet-related diseases—this strategy identifies ambitious and achievable actions across five pillars:

1. Improving food access and affordability, including by advancing economic security; increasing access to free and nourishing school meals;

2. Integrating nutrition and health, including by working with Congress to pilot coverage of medically tailored meals in Medicare; testing Medicaid coverage of nutrition education and other nutrition supports using Medicaid section 1115 demonstration projects; and expanding Medicaid and Medicare beneficiaries’ access to nutrition and obesity counseling;

3. Empowering all consumers to make and have access to healthy choices, including by proposing to develop a front-of-package labeling scheme for food packages; proposing to update the nutrition criteria for the “healthy” claim on food packages; expanding incentives for fruits and vegetables in SNAP; facilitating sodium reduction in the food supply by issuing longer-term, voluntary sodium targets for industry; and assessing additional steps to reduce added sugar consumption, including potential voluntary targets;

4. Supporting physical activity for all, including by expanding the U.S. Department of Health and Human Services’ Centers for Disease Control and Prevention’s (CDC) State Physical Activity and Nutrition Program to all states and territories; and

5. Enhancing nutrition and food security research, including by bolstering funding to improve metrics, data collection, and research to inform nutrition and food security policy, particularly on issues of equity and access; and implementing a vision for advancing nutrition science.

**Emerging Science Area**

*Category: fMRI and food intake*

**A Highly Selective Response to Food in Human Visual Cortex Revealed by Hypothesis-Free Voxel Decomposition.** [Article link](https://www.current-biology.org/article/S0960-9822(22)00756-2)


**Significance:** fMRI is used to study food intakes and brain functions though such mapping often involves thousands of complex images. The findings from this study demonstrate the usefulness of data-driven methods to validate the dominant neural responses selective not just for everyday impressions but also for the visually heterogeneous category of food.

Prior work has identified cortical regions selectively responsive to specific categories of visual stimuli. However, this hypothesis-driven work cannot reveal how prominent these category selectivities are in the overall functional organization of the visual cortex, or what others might exist that scientists have not thought to look for. Furthermore, standard voxel-wise tests cannot detect distinct neural selectivities that coexist within voxels. To overcome these limitations, we used data-driven voxel decomposition methods to identify the main components underlying fMRI responses to thousands of complex photographic images. Our hypothesis-neutral analysis rediscovered components selective for faces, places, bodies, and words, validating our method and showing that these selectivities are dominant features of the ventral visual pathway. The analysis also revealed an unexpected component with a distinct anatomical distribution that responded highly selectively to images of food. Alternative accounts based on low- to mid-level visual features, such as color, shape, or texture, failed to account for the food selectivity of this component. High-throughput testing and control experiments with matched stimuli on a highly accurate computational model of this component confirm its selectivity for food. We registered our methods and hypotheses before replicating them on held-out participants and in a novel dataset. These findings demonstrate the power of data-driven methods and show that the dominant neural responses of the ventral visual pathway include not only selectivities for faces, scenes, bodies, and words but also the visually heterogeneous category of food, thus constraining accounts of when and why functional specialization arises in the cortex.
Engage with IAFNS

- **IAFNS-USDA Beltsville Webinar Series**  
  October 26, 2022 - December 1, 2022  
  Orlando, Florida  
  - Join us for a 4-part series co-organized by IAFNS and scientists with the USDA ARS Beltsville Human Nutrition Center with a focus on the following: Dietary Added Sugars, Complex Carbohydrates, Botanicals and Flavonoids.

  Find out more information about the four webinars [here](#).

- **Federal and State Efforts to Restrict PFAS: Impact on Food Companies**  
  November 14, 2022  
  Virtual, Event  
  - This webinar will highlight state laws and federal-level actions and how they might impact food companies and packaging suppliers. The webinar will also highlight EPA’s actions under the PFAS Strategic Roadmap and preview expected actions later in 2022 and beyond.

  Find more information about the webinar [here](#).

- **IAFNS Science Innovation Showcase - 2022**  
  December 13, 2022 - December 15, 2022  
  Virtual, Event  
  - This science-first and science-focused event will bring together scientists from multiple sectors, at all stages of their careers from graduate students to professors, technical experts to CEOs. Attendees will have the opportunity to engage in dialogue and discussion on the data, the technology and science being applied across the food and beverage ecosystem. Join us to learn about next generation possibilities!

  Find more information about the Science Innovation Showcase [here](#).