

August 2022

# Nutrition Science Briefs



## Dietary Patterns

### Associations Between Dietary Patterns and Cardiovascular Disease Risk in Canadian Adults: A Comparison of Partial Least Squares, Reduced Rank Regression and the Simplified Dietary Pattern Technique

Svilena V Lazarova, Mahsa Jessri. *Am J Clin Nutr.* 2022 Aug 4;116(2):362-377. doi: 10.1093/ajcn/nqac117. [Article link](#)

**Significance:** PLS and RRR methods were equally effective for identifying high-CVD-risk dietary patterns in Canadian adults. Both approaches identified highly similar energy-dense, high-saturated-fats, and low-fiber-dense dietary patterns, with more loadings for fast food, carbonated drinks, salty snacks, and solid fats, and less loadings for fruit, vegetables (dark green vegetables, red and orange), whole grains, and legumes and soy. Future studies may need to further determine the role of major dietary components involved in CVD risks.



**Background:** Hybrid methodologies have gained continuing interest as unique data reduction techniques for establishing a direct link between dietary exposures and clinical outcomes. **Objectives:** We aimed to compare partial least squares (PLS) and reduced rank regression (RRR) in identifying a dietary pattern associated with a high cardiovascular disease (CVD) risk in Canadian adults, construct PLS- and RRR-based simplified dietary patterns and assess associations between the 4 dietary pattern scores and CVD risk. **Methods:** Data were collected from 24-h dietary recalls of adult respondents in the 2 cycles of the nationally representative Canadian Community Health Survey (CCHS)-Nutrition: CCHS 2004 linked to health administrative databases ( $n = 12,313$ ) and CCHS 2015 ( $n = 14,020$ ). Using 39 food groups, PLS and RRR were applied for identification of an energy-dense (ED), high-saturated-fat (HSF), and low-fiber-density (LFD) dietary pattern.

Associations of the derived dietary pattern scores with lifestyle characteristics and CVD risk were examined using weighted multivariate regression and weighted multivariable-adjusted Cox proportional hazard models, respectively. **Results:** PLS and RRR identified highly similar ED, HSF, and LFD dietary patterns with common high positive loadings for fast food, carbonated drinks, salty snacks, and solid fats, and high negative loadings for fruit, dark green vegetables, red and orange vegetables, other vegetables, whole grains, and legumes and soy ( $\geq |0.17|$ ). Food groups with the highest loadings were summed to form simplified pattern scores. Although the dietary patterns were not significantly associated with CVD risk, they were positively associated with 402-kcal/d higher energy intake ( $P$ -trends  $< 0.05$ ) and higher obesity risk (PLS: OR: 2.09; 95% CI: 1.62, 2.70; RRR: OR: 1.76; 95% CI: 1.44, 2.17) ( $P$ -trends  $< 0.0001$ ) in the fourth quartiles. **Conclusions:** PLS and RRR were shown to be equally effective for the derivation of a high-CVD-risk dietary pattern among Canadian adults. Further research is warranted on the role of major dietary components in cardiovascular health.

## Carbohydrates

### Guidance and Perspectives on Highly Processed Foods

Shirin Panahi, Wendelyn Jones, Alison M. Duncan, Guylaine Ferland, Heather H. Keller, Andrea Grantham, James D House. *Applied Physiology, Nutrition and Metabolism.* 4 August 2022. doi.org/10.1139/apnm-2022-0150. [Article link](#)

**Significance:** A Food for Health Workshop convened by the Canadian Nutrition Society and Institute for the Advancement of Food and Nutrition Sciences explored the advantages and disadvantages of HPF. Multidisciplinary experts from private and public sectors presented evidence, perspectives and guidance when advocating limits, identified potential unintended consequences and explored the implications, and necessity of HPF in clinical settings.



This effort was in part supported by IAFNS

**Abstract:** Guidance from Health Canada to limit highly processed foods (HPF) seeks to ensure that Canadians remain within intake recommendations for nutrients of concern. However, HPF can contribute to dietary requirements of specific populations. The Canadian Nutrition Society and Institute for the Advancement of Food and Nutritional Sciences convened speakers for a Food for Health workshop in 2021 to provide evidence and perspectives from government, industry, and healthcare on reasons for advocating limits and potential unintended consequences of limiting HPF, and implications and necessity of HPF in clinical settings. This paper discusses advantages and disadvantages of HPF explored at this workshop.

## Protein

### Consumption of Nuts and Seeds and Health Outcomes Including Cardiovascular, Diabetes and Metabolic Disease, Cancer, and Mortality: An Umbrella Review

Rajiv Balakrishna, Tonje Bjørnerud, Mitra Bemanian, Dagfinn Aune, Lars T Fadnes. *Adv Nutr*. 2022 Aug 30; doi: 10.1093/advances/nmac077. [Article link](#)

**Significance:** Analysis from 89 papers concluded that daily consumption of 28g versus none of nuts and seeds was associated with relative risk reduction of CVD (21%), cancer deaths (11%), and all-cause mortality (22%). Data on diabetes was mixed, and an inverse relationship was observed for respiratory disease. Current evidence supports recommendations to consume a handful of nuts and seeds daily for people without allergies to these foods.

Consumption of nuts and seeds is associated with a range of health outcomes. Summarizing the best evidence on essential health outcomes from the consumption of nuts is essential to provide optimal recommendations. Our objective is to comprehensively assess health outcomes associations related to the consumption of nuts and seeds, using a culinary definition including tree nuts and peanuts (registered in PROSPERO: CRD42021258300). Health outcomes of interest include cardiovascular disease, cancer, diabetes, obesity, respiratory disease, mortality, and their biomarker for disease. We present associations for high versus low consumption, per serving, and dose-response relationships. Medline, Embase, Cochrane, and Epistemonikos were searched and screened for systematic reviews and meta-analyses. Evidence was extracted from 89 articles on the consumption of nuts and relevant health outcomes, including 23 articles with meta-analysis on disease and mortality, 66 articles on biomarkers for disease, and 9 articles on allergy/adverse outcomes. Intake of nuts was associated with reduced risk of cardiovascular diseases and related risk factors, with moderate quality of evidence. An intake of 28 grams of nuts per day compared to not eating nuts was associated with a 21% relative risk reduction of cardiovascular disease (including coronary heart disease incidence and mortality, atrial fibrillation, and stroke mortality), 11% risk reduction of cancer deaths, and 22% reduction in all-cause mortality. Nut consumption was also inversely associated with mortality from respiratory diseases, infectious diseases, and diabetes: however, associations between nut consumption and diabetes incidence were mixed. Meta-analyses of trials on biomarkers for disease generally mirrored meta-analyses from observational studies on cardiovascular disease, cancers, and diabetes. Allergy and related adverse reactions to nuts were observed among 1-2% of adult populations, with substantial heterogeneity between studies. Overall, the current evidence supports dietary recommendations to consume a handful of nuts and seeds per day for people without allergies to these foods.

## Low- and No-Calorie Sweeteners

### Consumption of Low-Calorie Sweetened Drinks is Associated with ‘Sweet Satiation’, but not with ‘Sweet-Taste Confusion’: A Virtual Study

Angelica M Monge, Danielle Ferriday, Simon Heckenmueller, Jeffrey M Brunstrom, Peter J Rogers. *Appetite*. 2022 Aug 10;178. doi: 10.1016/j.appet.2022.106273. [Article link](#)

**Significance:** A virtual study with human subjects found a sweet satiation response after an exposure to LCS – not sweet-taste confusion as previously reported in rat studies.

Originating from studies on rats, the ‘taste confusion’ hypothesis predicts that exposure to low-calorie sweeteners (LCS) will impair compensatory responses to sugar intake, resulting in increased overall calorie intake. We conducted a virtual study in which young adult human participants (n = 332), who differed in their history of exposure to sweet drinks (e.g., drank ‘diet’ (LCS) soft drinks or ‘regular’ (sugar-sweetened) soft drinks), imagined consuming a cheese sandwich and two-thirds of a 500 ml drink (still water, sparkling water, diet Coca Cola, regular Coca Cola, or semi-skimmed milk), or no drink, as a hypothetical lunch-time meal. They then used a screen-based tool to select the amount of a sweet snack (chocolate M&M’s) or savoury snack (salted peanuts) that they would eat immediately with the remaining third of their drink (i.e., a total of 12 drink and snack combinations per participant). The results were inconsistent with the

---

predictions of the taste confusion hypothesis; specifically, the extent to which consumption of sugar cola compared with water (still or sparkling) reduced snack intake did not differ between habitual diet (LCS) and habitual sugar soft-drink consumers. Other results showed a 'sweet satiation' effect (i.e., lower sweet versus savoury snack intake when the drink accompanying the meal was sweet compared with when it was water), and negligible compensation in snack food intake for the difference in the energy content of diet versus sugar cola.

## Cognitive Health

### Effects of Anthocyanin-Rich Supplementation on Cognition of the Cognitively Healthy Middle-Aged and Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Ruo Chen Feng, Yan Hong Dong, Xian Li Hong, Ya Su, Xi Vivien Wu. *Nutr Rev.* 2022 Aug 12. doi: 10.1093/nutrit/nuac055. [Article link](#)

**Significance:** Anthocyanin supplementation in healthy middle-aged and older adults significantly enhanced speed of cognitive processing, suggesting improvement in daily functions and quality of life. However, no significant improvement was reported for other outcomes such as memory attention, executive function and psychomotor performance. This meta-analysis review provides insights for future method design to explore the mechanism of action of anthocyanins.

**Context:** The prevalence of age-related cognitive decline has been on the rise as the global population age, putting the independence and quality of life of elderly at risk. Anthocyanin, as a subclass of dietary flavonoids, may have a beneficial impact on cognitive outcomes. **Objectives:** To examine the effects of dietary anthocyanin supplementation on cognition of the cognitively healthy middle-aged and older adults. Data sources: PubMed, ScienceDirect, CINAHL, EMBASE, ProQuest and Cochrane databases were searched. **Data extraction and analysis:** Thirteen studies were included in this meta-analysis. Anthocyanin-rich supplementation was found to significantly improve the processing speed of the older adults (95%CI 0.08, 0.44;  $P = 0.004$ ). No significant differences were observed between intervention and control groups on memory, attention, executive function and psychomotor performance. Current neuroimaging studies have found promising effects of anthocyanin supplementation on brain activation and cerebral perfusion. **Conclusion:** Anthocyanin-rich supplementation may preserve cognitive processing speed and neuro-activities in older adults, which improves their daily functioning and quality of life. This review provides useful insights to guide direction and methodological designs for future studies to explore the underlying mechanisms of anthocyanins.

## Lipids

### Impact of Replacement of Individual Dietary SFAs on Circulating Lipids and Other Biomarkers of Cardiometabolic Health: A Systematic Review and Meta-Analysis of Randomized Controlled Trials in Humans

Laury Sellem, Matthieu Flourakis, Kim G Jackson, Peter J Joris, James Lumley, Szimonetta Lohner, Ronald P Mensink, et. al. *Adv Nutr.* 2022 Aug 1;13(4):1200-1225. doi: 10.1093/advances/nmab143. [Article link](#)

**Significance:** Replacing dietary palmitic acid with UFAs on lipid biomarkers is consistent with current public health recommendations. Due to high heterogeneity and limited studies in this area, future research needs to include RCT studies to further elucidate the relationship between all individual SFAs and biomarkers of cardiometabolic health.

Little is known of the impact of individual SFAs and their isoenergetic substitution with other SFAs or unsaturated fatty acids (UFAs) on the prevention of cardiometabolic disease (CMD). This systematic literature review assessed the impact of such dietary substitutions on a range of fasting CMD risk markers, including lipid profile, markers of glycemic control and inflammation, and metabolic hormone concentrations. Eligible randomized controlled trials (RCTs) investigated the effect of isoenergetic replacements of individual dietary SFAs for  $\geq 14$  d on  $\geq 1$  CMD risk markers in humans. Searches of the PubMed, Embase, Scopus, and Cochrane CENTRAL databases on 14 February, 2021 identified 44 RCTs conducted in participants with a mean  $\pm$  SD age of  $39.9 \pm 15.2$  y. Studies' risk of bias was assessed using the Cochrane Risk of Bias tool 2.0 for RCTs. Random-effect meta-analyses assessed the effect of  $\geq 3$  similar dietary substitutions on the same CMD risk marker. Other dietary interventions were described in qualitative syntheses. We observed reductions in LDL-cholesterol concentrations after the replacement of palmitic acid (16:0) with UFAs (-0.36 mmol/L; 95% CI: -0.50, -0.21 mmol/L;  $I^2 = 96.0\%$ ,  $n = 18$  RCTs) or oleic acid (18:1n-9) (-0.16 mmol/L; 95% CI: -0.28, -0.03 mmol/L;  $I^2 = 89.6\%$ ,  $n = 9$  RCTs), with a similar impact on total cholesterol and apoB concentrations. No effects on other CMD risk markers, including HDL-cholesterol, triacylglycerol, glucose, insulin, or C-reactive protein concentrations, were evident. Similarly, we found no evidence of a benefit from replacing dietary stearic acid (18:0) with UFAs on CMD risk markers ( $n = 4$  RCTs). In conclusion, the impact of replacing dietary palmitic acid with UFAs on lipid biomarkers is aligned with current public

---

health recommendations. However, owing to the high heterogeneity and limited studies, relations between all individual SFAs and biomarkers of cardiometabolic health need further confirmation from RCTs.

## Sodium

### Application of Umami Tastants on Sodium Reduction in Food: An Evidence Analysis Center Scoping Review

Kristi M Crowe-White, Megan Baumler, Erica Gradwell, Vijaya Juturu, Dana Angelo White, Deepa Handu. *J Acad Nutr Diet.* 2022 Aug 5, 2022; 22:212-2672. doi: 10.1016/j.jand.2022.08.002. [Article link](#)

**Significance:** Umami tastants contribute to savory favor and are beneficial in reducing dietary salt intake. A recent literature search identified 52 studies (with most in MSG) designed for food acceptability and only one study on dietary salt intake reduction. Future research on umami tastants needs to consider including systematic reviews and prospective trials that have both intermediate (dietary pattern changes, daily dietary intake of sodium, and blood pressure) and hard outcomes (incidence of hypertension or stroke as well as cardiovascular composite outcomes).

**Background:** Sodium chloride intake far exceeds guidelines by health and regulatory agencies. Acknowledging the positive relationship between sodium intake and blood pressure, interest in substances which assist in sodium reduction while contributing a savory taste such as umami are highly investigated. **Objective:** The objective of this scoping review was to identify and characterize studies investigating umami tastants on sodium reduction in food with the goal of informing future research. **Methods:** A literature search was conducted in Medline, Embase, Cochrane Database, EBSCO PsycInfo, PROSPERO, NIH Reporter, Clinical Trials.gov and WHO Trials and completed in March 2022 to identify peer-reviewed publications among adults ( $\geq 18$  years) with interventions focusing on umami tastants to reduce sodium content. **Results:** The literature search identified 52 studies among which mono-sodium glutamate (MSG) was the most studied umami tastant or food. Further, the majority of research on umami was represented through cross-sectional sensory studies to determine acceptability of foods with part of the original sodium chloride replaced by umami tastants. Only one study investigated the use of an umami tastant on overall daily sodium intake. **Conclusions:** To assist individuals in adhering to sodium reduction intake goals set forth by regulatory agencies and their guiding policies, these findings indicate that additional research on umami tastants including systematic reviews and prospective trials is warranted. In these prospective studies, both intermediate outcomes (dietary pattern changes, daily dietary intake of sodium, and blood pressure) and hard outcomes (incidence of hypertension or stroke as well as cardiovascular composite outcomes) should be considered.

## Gut Microbiome

### *Akkermansia muciniphila* Phospholipid Induces Homeostatic Immune Responses

Munhyung Bae, Chelsi D Cassilly, Xiaoxi Liu, Sung-Moo Park, Betsabeh Khoramian Tusi, Xiangjun Chen, Jaeyoung Kwon, et. al. *Nature.* 2022 Aug;608(7921):168-173. doi: 10.1038/s41586-022-04985-7. [Article link](#)

**Significance:** The molecular mechanism underlying the association of human gut bacteria and host physiology has been challenging to understand. A recent study reported the identification of a lipid from *A. muciniphila*'s cell membrane that recapitulates the immunomodulatory activity of *A. muciniphila* in cell-based assays. The isolated immunogen, a diacyl phosphatidylethanolamine with two branched chains, was characterized through both spectroscopic analysis and chemical synthesis.

**Abstract:** Multiple studies have established associations between human gut bacteria and host physiology but determining the molecular mechanisms underlying these associations has been challenging. *Akkermansia muciniphila* has been robustly associated with positive systemic effects on host metabolism, favourable outcomes to checkpoint blockade in cancer immunotherapy and homeostatic immunity. Here we report the identification of a lipid from *A. muciniphila*'s cell membrane that recapitulates the immunomodulatory activity of *A. muciniphila* in cell-based assays. The isolated immunogen, a diacyl phosphatidylethanolamine with two branched chains (a15:0-i15:0 PE), was characterized through both spectroscopic analysis and chemical synthesis. The immunogenic activity of a15:0-i15:0 PE has a highly restricted structure-activity relationship, and its immune signaling requires an unexpected toll-like receptor TLR2-TLR1 heterodimer. Certain features of the phospholipid's activity are worth noting: it is significantly less potent than known natural and synthetic TLR2 agonists; it preferentially induces some inflammatory cytokines but not others; and, at low doses (1% of EC<sub>50</sub>) it resets activation thresholds and responses for immune signaling. Identifying both the molecule and an equipotent synthetic analogue, its non-canonical TLR2-TLR1 signaling pathway, its immunomodulatory selectivity and its low-dose immunoregulatory effects provide a molecular mechanism for a model of *A. muciniphila*'s ability to set immunological tone and its varied roles in health and disease.

## 9a Yf[ ]b[ 'GVYbW' 5fYUg

Emerging Topic: Hunger and Nutrition Security

Category: Nutrition Sustainability

### **Strengthening US Food Policies and Programs to Promote Equity in Nutrition Security: A Policy Statement from the American Heart Association**

Anne N. Thorndike, Christopher D. Gardner, Katherine Bishop Kendrick, Hilary K. Seligman, Amy L. Yaroch, Aldrin V. Gomes, Kendra N. Ivy, Stephanie Scarmo, et. al. *Circulation*. 2022;145: August 2022. doi.org/10.1161/CIR.0000000000001072. [Article link](#)

**Significance:** This report summarizes AHA's scientific position on promoting equality in nutrition security. It emphasizes the importance of "nutritional quality, improving reach, ensuring optimal utilization, improving coordination across programs, ensuring stability of access to programs across the life course, and ensuring equity and dignity for access and utilization." It calls for innovation in expanding food assistance policies and programs that will improve cardiovascular health and reduce disparities in chronic disease.

Nutritionally inadequate dietary intake is a leading contributor to chronic cardiometabolic diseases. Differences in dietary quality contribute to socioeconomic and racial and ethnic health disparities. Food insecurity, a household-level social or economic condition of limited access to sufficient food, is a common cause of inadequate dietary intake. Although US food assistance policies and programs are designed to improve food security, there is growing consensus that they should have a broader focus on nutrition security. In this policy statement, we define nutrition security as an individual or household condition of having equitable and stable availability, access, affordability, and utilization of foods and beverages that promote well-being and prevent and treat disease. Despite existing policies and programs, significant gaps remain for achieving equity in nutrition security across the life span. We provide recommendations for expanding and improving current food assistance policies and programs to achieve nutrition security. These recommendations are guided by several overarching principles: emphasizing nutritional quality, improving reach, ensuring optimal utilization, improving coordination across programs, ensuring stability of access to programs across the life course, and ensuring equity and dignity for access and utilization. We suggest a critical next step will be to develop and implement national measures of nutrition security that can be added to the current US food security measures. Achieving equity in nutrition security will require coordinated and sustained efforts at the federal, state, and local levels. Future advocacy, innovation, and research will be needed to expand existing food assistance policies and programs and to develop and implement new policies and programs that will improve cardiovascular health and reduce disparities in chronic disease.

## 9b[ U[ Y'k ]A '5: BG

- **FNCE**

October 8-11, 2022

Orlando Florida

- Two IAFNS science projects will be presented at FNCE 2022! Each fall, the Academy of Nutrition and Dietetics sponsors the world's largest meeting of food, nutrition and dietetics experts to address key issues affecting the health of individuals and communities throughout the country and around the world. The two IAFNS sessions are:

Are We Ready? Dietary Recommendations Based on Direct-to-Consumer Gut Microbiome Tests

Flavanols and Cardiometabolic Health: Examining the First Ever Dietary Bioactive Guideline

Find out more information about FNCE 2022 [here](#).

- **Sample Collection, Preservation, and Data Analysis in Gut Microbiome Research: Current Methods and Potential Impact on Results**

October 13, 2022. 12:00-2:30 pm ET.

Virtual, Event

- Part of the American Society for Nutrition's NUTRITION 2022 Annual Satellite Series.
- In this session, the current state of knowledge related to sample collection, utility of standards, sequencing, and bioinformatic and biostatistical approaches will be reviewed by experts working in the field. Speakers will expand on how selection among the various methodological options can impact study results. Find out more information about the event [here](#).

---

- **IAFNS Science Innovation Showcase – 2022**

December 13-15, 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 including plant-based proteins and other alternatives. Join us to learn about next generation possibilities! Find out more information about the Science Innovation Showcase [here](#).