May 2022

# Nutrition Science Briefs

## IAFNS Annual Meeting & Science Symposium

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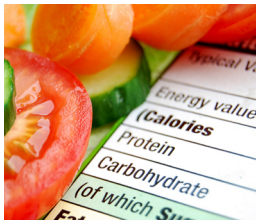
## Dietary Patterns

### A Systematic Review of Supermarket Automated Electronic Sales Data for Population Dietary Surveillance




Victoria L Jenneson, Francesca Pontin, Darren C Greenwood, Graham P Clarke, Michelle A Morris. *Nutr Rev*. 2022 May 9;80(6):1711-1722. doi: 10.1093/nutrit/nuab089. **Article link**

**Significance:** A systematic review of electronic sales data from four large databases (MEDLINE, EMBASE, PsycINFO and Global Health ) of healthy, free-living adults offers a potential approach to study dietary assessment and food purchase behavior and nutritional intakes. However, validation studies are needed to confirm methodological limitations including extrapolation to the individual level.

**Context:** Most dietary assessment methods are limited by self-report biases, how long they take for participants to complete, and cost of time for dietitians to extract content. Electronically recorded, supermarket-obtained transactions are an objective measure of food purchases, with reduced bias and improved timeliness and scale. **Objective:** The use, breadth, context, and utility of electronic purchase records for dietary research is assessed and discussed in this systematic review. **Data sources:** Four electronic databases (MEDLINE, EMBASE, PsycINFO, Global Health) were searched. Included studies used electronically recorded supermarket transactions to investigate the diet of healthy, free-living adults. **Data extraction:** Searches identified 3422 articles, of which 145 full texts were retrieved and 72 met inclusion criteria. Study quality was assessed using the National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. **Data analysis:** Purchase records were used in observational studies, policy evaluations, and experimental designs. Nutrition outcomes included dietary patterns, nutrients, and food category sales. Transactions were linked to nutrient data from retailers, commercial data sources, and national food composition databases.**Conclusion:** Electronic sales data have the potential to transform dietary assessment and worldwide understanding of dietary behavior. Validation studies are warranted to understand limits to agreement and extrapolation to individual-level diets.

## Carbohydrates

### Importance of Carbohydrate Quality: What Does It Mean and How to Measure It?

Vanessa Campos, Luc Tappy, Lia Bally, John L Sievenpiper, Kim-Anne Lê. *J Nutr*. 2022 May 5;152(5):1200-1206. doi: 10.1093/jn/nxac039. **Article link**

**Significance:** This summary review highlights the importance of considering both carbohydrate quality and its food form or processing level — all of which can affect energy efficiency and the cardiometabolic risk associated with different types of carbohydrates.

Dietary carbohydrates are our main source of energy. Traditionally, they are classified based on the polymer length between simple and complex carbohydrates, which does not necessarily reflect their impact on health. Simple sugars, such as fructose, glucose, and lactose, despite having a similar energy efficiency and caloric content, have very distinct

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metabolic effects, leading to increased risk for various chronic diseases when consumed in excess. In addition, beyond the absolute amount of carbohydrate consumed, recent data point out that the food form or processing level can modulate both the energy efficiency and the cardiometabolic risk associated with specific carbohydrates. To account for both of these aspects-the quality of carbohydrates as well as its food form-several metrics can be proposed to help identifying carbohydrate-rich food sources and distinguish between those that would favor the development of chronic diseases and those that may contribute to prevent these. This review summarizes the findings presented during the American Society of Nutrition Satellite symposium on carbohydrate quality, in which these different aspects were presented.

### A Scoping Review of Epidemiological Studies on Intake of Sugars in Geographically Dispersed Asian Countries: Comparison of Dietary Assessment Methodology

Aya Fujiwara, Yuka Omura, Fumi Oono, Minami Sugimoto, Satoshi Sasaki, Hidemi Takimoto. *Adv Nutr*. 2022 May 31;nmac061. doi: 10.1093/advances/nmac061. **Article link**

**Significance:** Sugar intake reported from most epidemiological studies from Asian countries were of poor quality, according to a recent scoping review. The study found that feasible and validated dietary assessment methods along with comprehensive country-specific sugars composition databases are needed to ensure high quality studies with accurate sugars intake for health outcome studies.

Previous systematic reviews, which focused on sugars intake and its relationship with health issues were mainly conducted in Western countries, not Asian countries characterized by differences in dietary habits and disease prevalence. The scarcity of Asian studies may be attributed to the lack of assessment tools for estimating sugars intake. To provide an overview of the epidemiological studies on sugars intake in Asian countries, with a primary focus on dietary assessment methodology for estimating sugars intake, we conducted a scoping review of the epidemiological studies estimating sugars intake in Asian countries (the United Nations' definition) and Taiwan using PubMed and Web of Science. Study quality was evaluated based on its assessment of sugars intake in the whole diet, dietary assessment methods, and data sources used for estimating sugars content. We identified 143 studies from 136 publications from Eastern (n=63), Southern (n=30), South-eastern (n=26), and Western (n=24) Asia. Total sugars were investigated in 95 studies, while 23-30 studies investigated sucrose, fructose, added sugars, and free sugars. The main aim of the selected studies was assessment of diet-disease relationships (n=85) and estimation of dietary intake (n=40), and 62 studies assessed sugars as the primary exposure/outcome. One hundred twenty studies assessed sugars intake in the whole diet, and 62 studies used validated FFQ or multiple-day dietary assessment methods. Only 41 studies used country-specific comprehensive food composition databases or directly measured the sugars content. Only 17 studies reported high-quality data. This review elucidated a sufficient number of epidemiological studies estimating sugars intake across Asian countries; however, most studies reported low-quality data. The results from our review showed that both feasible and validated dietary assessment methods, as well as comprehensive country-specific sugars composition databases, are essential for producing high quality studies with accurate sugars intake to examine their association with health outcomes.

## Protein

### Grains - A Major Source of Sustainable Protein for Health

Kaisa S Poutanen, Anna O Kårlund, Carlos Gómez-Gallego, Daniel P Johansson, Nathalie M Scheers, Ingela M Marklinder, Anne K Eriksen, et. al. *Nutr Rev*. 2022 May 9;80(6):1648-1663. doi: 10.1093/nutrit/nuab084. **Article link**

**Significance:** Cereal grain protein offers an alternate way to accelerate transition to sustainable protein sources. This can be achieved by shifting current balance in grain usage from feed to more developments of traditional foods, new foods and ingredients.

Cereal grains are the main dietary source of energy, carbohydrates, and plant proteins world-wide. Currently, only 41% of grains are used for human consumption, and up to 35% are used for animal feed. Cereals have been overlooked as a source of environmentally sustainable and healthy plant proteins and could play a major role in transitioning towards a more sustainable food system for healthy diets. Cereal plant proteins are of good nutritional quality, but lysine is often the limiting amino acid. When consumed as whole grains, cereals provide health-protecting components such as dietary fiber and phytochemicals. Shifting grain use from feed to traditional foods and conceptually new foods and ingredients could improve protein security and alleviate climate change. Rapid development of new grain-based food ingredients and use of grains in new food contexts, such as dairy replacements and meat analogues, could accelerate the transition. This review discusses recent developments and outlines future perspectives for cereal grain use.

## Low- and No-Calorie Sweeteners

### Consumer Expectation of Flavored Water Function, Sensory Quality, and Sugar Reduction, and the Impact of Demographic Variables and Woman Consumer Segment

Uijeong An, Xiaofen Du, Wanyi Wang. *Foods*. 2022 May 16;11(10):1434. doi: 10.3390/foods11101434. **Article link**

**Significance:** This study of 901 consumers found that flavored water ranked fourth in consumer beverage choices, in addition to extensive data on consumer functional and sensory preferences and expectations of flavored waters.

This study aimed to investigate consumer expectation of flavored water and potential consumer segments. The results showed flavored water was ranked the fourth most popular drink, after plain water, tea, and coffee, by 901 participants. Consumers highly expected functional flavored water with refreshing (87.4% selection), thirst-quenching (73.7%), and tasty (65.7%) qualities, containing vitamins, minerals, and antioxidants, and providing energy. Expected flavored water sensory qualities included temperature (62.4%), flavor (52.4%), and sweet taste (47.4%); lemon, berry, and lime flavors were most preferred, while bitterness, irritation, astringency, and sourness were least preferred. Pure sugar and honey were rated highest as the sweeteners for flavored water. Likewise, consumers were mostly concerned with taste followed by calories. Single demographic variables (age, reported health condition, drinking frequency, educational level) significantly influenced ($p \leq 0.05$) flavored water function, sensory quality, and sugar reduction expectations. Females had higher expectation of flavored water's refreshing and antioxidant functions. Cluster analysis revealed two consumer segments. The younger, low-education, self-reportedly less healthy cluster (mainly college students) expected various functions and flavors such as low temperature, cooling taste, diverse flavors, and sweet taste (and disliked bitterness). The older, educated, employed, self-reportedly healthy cluster had lower expectations of flavored water functions, were less sensitive to bitterness, and preferred no sweetness or little sweetness. These findings provide informative data to establish marketing and sales strategies for promoting flavored water.

## Cognitive Health

### n-3 PUFA Improve Emotion and Cognition during Menopause: A Systematic Review.

Davide Decandia, Eugenia Landolfo, Stefano Sacchetti, Francesca Gelfo, Laura Petrosini, Debora Cutuli. *Nutrients*. 2022 May 9;14(9):1982. doi: 10.3390/nu14091982. **Article link**

**Significance:** While finding ambiguous effects on anxiety and cognition in humans, n-3 PUFA consistently reduced anxiety symptoms and improved cognition in animal studies. n-3 PUFA intake shows beneficial effects on emotional and cognitive behaviors during menopause transition.

Women show an increased risk of cognitive impairment and emotional disorders, such as anxiety and depression, when approaching menopause. Data on risk and protection factors have yielded robust evidence on the effects of lifestyle factors, such as diet, in preserving emotional and cognitive functioning. This review focused on the effects of omega-3 polyunsaturated fatty acids (n-3 PUFA) on anxiety, depression, and cognition during the menopausal transition. This systematic review considered all articles published until 31 December 2021, and the search was performed on two databases, PubMed and Scopus. The fields of interest were "menopause", "n-3 PUFA" and "emotional and cognitive aspects". Out of the 361 articles found on PubMed and 283 on Scopus, 17 met inclusion criteria. They encompassed 11 human and 6 animal studies. Most studies reported relieved depressive symptoms in relation to n-3 PUFA intake. While controversial results were found on anxiety and cognition in humans, n-3 PUFA consistently reduced anxiety symptoms and improved cognition in animal studies. Taken together, n-3 PUFA intake shows beneficial effects on emotional and cognitive behaviours during menopause transition. However, further investigations could increase knowledge about the effectiveness of n-3 PUFA on psychological well-being in this delicate period of feminine life.

## Lipids

### The Health Benefits of Anthocyanins: An Umbrella Review of Systematic Reviews and Meta-Analyses of Observational Studies and Controlled Clinical Trials

Berner-Andrée Sandoval-Ramírez, Úrsula Catalán, Elisabet Llauradó, Rosa-María Valls, Patricia Salamanca, Laura Rubió, Silvia Yuste, Rosa Solà. *Nutr Rev*. 2022 May 9;80(6):1515-1530. doi: 10.1093/nutrit/nuab086. **Article link**

**Significance:** An umbrella analysis of systematic and meta reviews of both observational and controlled studies of anthocyanins (ACNs) and health outcomes found no associations between ACNs and breast or gastric cancer risks, and opened new ways to manage blood lipids, glucose metabolism, and endothelial function, without affecting blood pressure.

Anthocyanins (ACNs) are phenolic compounds present in foods and have undefined health benefits. The present umbrella review aimed to analyze the effects of ACNs on multiple aspects of human health (from systematic reviews and meta-analyses [SRMs] of randomized controlled trials [RCTs]), and the associations of ACNs with the risk of various diseases (from SRMs of observational studies [OSs]). Following the PRISMA methodology, the PubMed, SCOPUS, and Cochrane databases were searched up to November 1, 2020 for OS-SRMs and RCT-SRMs that examined the effects of ACNs on health. The risk of bias of RCT-SRMs was assessed using the AMSTAR 2, and that of OS-SRMs was assessed using the Joanna Briggs Institute methodology. Based on 5 OS-SRMs (57 studies and 2 134 336 participants), ACNs of various sources were significantly associated with a reduction in the risks of hypertension and type 2 diabetes mellitus. According to 8 RCT-SRMs (139 interventions and >4984 participants), ACNs improved plasmatic lipids, glucose metabolism, and endothelial function, without affecting blood pressure. No associations between ACNs and breast or gastric cancer risks were found. ACN intake opens new pathways for the management of glucose metabolism, the plasmatic lipid profile, and the improvement of endothelial function in humans.

## Sodium

### The Impact of Excessive Salt Intake on Human Health

Robert W Hunter, Neeraj Dhaun, Matthew A Bailey. *Nat Rev Nephrol*. 2022 May;18(5):321-335. doi: 10.1038/s41581-021-00533-0. **Article link**

**Significance:** High salt intake impacts disease pathogenesis in multiple organs including the kidney, brain, vasculature, and immune system, Therapeutic interventions in these pathways has yet to be tested, and the issue is further compounded by growing inequalities in the food systems, impeding individual dietary control of salt intake. Current effective salt-reduction interventions have been at the population level involving government, education, and the food industry.

Updating evidence-based nutrient guidance is challenging. One set of recommendations for which a robust evidence base is essential is the Dietary References Intakes (DRI). In the past ten years, DRI values for four essential nutrients have been re-evaluated in two groups: vitamin D and calcium, and sodium and potassium. To support the work of the committees tasked with evaluating the available evidence, the federal agencies that sponsor the DRI reviews contracted with the Agency for Healthcare Research and Quality (AHRQ) to perform systematic reviews on predefined questions for these nutrient groups. Our aims were to tabulate the studies included in these systematic reviews and then, within the context of prespecified outcomes, summarize the totality of the available evidence and identify areas for consideration to maximize the value of the end products for future DRI committees. For the outcomes of interest, the available studies did not tend to report age data consistent with the current DRI categories. For some life stage categories, particularly pregnancy and lactation, there is a dearth of data. A wide range of study interventions were used, making it challenging to combine data to accurately derive or re-evaluate DRI values. There is also an under representation of data on race/ethnicity and overweight/obesity, which is of concern, given the shifting demographic in the U.S. and Canadian populations. Moving forward, it may be advantageous to develop a process to prospectively target research funding for studies designed to generate data that will most closely support re-evaluation of DRI values.

## Gut Microbiome

### A Guide to Dietary Pattern-Microbiome Data Integration

Yuni Choi, Susan L Hoops, Calvin J Thomas, Abigail J Johnson. *J Nutr*. 2022 May 5;152(5):1187-1199. doi: 10.1093/jn/nxac033. **Article link**

**Significance:** This report summarized current issues related to lack of data and methodological standardization in diet-microbiome research and identified current state of the art for diet-microbiome data integration. It also highlighted ways dietary data could be paired with microbiome data in future studies to improve the detection of diet-microbiome signals.

The human gut microbiome is linked to metabolic and cardiovascular disease risk. Dietary modulation of the human gut microbiome offers an attractive pathway to manipulate the microbiome to prevent microbiome-related disease. However, this promise has not been realized. The complex system of diet and microbiome interactions is poorly understood. Integrating observational human diet and microbiome data can help researchers and clinicians untangle the complex systems of interactions that predict how the microbiome will change in response to foods. The use of

dietary patterns to assess diet-microbiome relations holds promise to identify interesting associations and result in findings that can directly translate into actionable dietary intake recommendations and eating plans. In this article, we first highlight the complexity inherent in both dietary and microbiome data and introduce the approaches generally used to explore diet and microbiome simultaneously in observational studies. Second, we review the food group and dietary pattern-microbiome literature focusing on dietary complexity-moving beyond nutrients. Our review identified a substantial and growing body of literature that explores links between the microbiome and dietary patterns. However, there was little standardization of dietary collection and assessment methods across studies. The 54 studies identified in this review used ≥7 different methods to assess diet. Coupled with the variation in final dietary parameters calculated from dietary data (e.g., dietary indices, dietary patterns, food groups, etc.), few studies with shared methods and assessment techniques were available for comparison. Third, we highlight the similarities between dietary and microbiome data structures and present the possibility that multivariate and compositional methods, developed initially for microbiome data, could have utility when applied to dietary data. Finally, we summarize the current state of the art for diet-microbiome data integration and highlight ways dietary data could be paired with microbiome data in future studies to improve the detection of diet-microbiome signals.

## Emerging Science Areas

### *Category: Food Compositional Data Quality and Quantity*

### Nutrient Concentrations in Food Display Universal Behaviour

Menichetti, G., Barabási, AL. *Nat Food* 3, 375–382. 24 May, 2022. doi.org/10.1038/s43016-022-00511-0. **Article link**

**Significance:** Natural nutrient variability in foods may show a universal single-parameter scaling law rooted in its metabolic pathway, according to an analysis of the US food supply. This study offers a mathematical approach for calculating imputed nutrient content and is helpful in better understanding the impact of processing.

Extensive programmes around the world endeavour to measure and catalogue the composition of food. Here we analyse the nutrient content of the full US food supply and show that the concentration of each nutrient follows a universal single-parameter scaling law that accurately captures the eight orders of magnitude in nutrient content variability. We show that the universality is rooted in the biochemical constraints obeyed by the metabolic pathways responsible for nutrient modulation, allowing us to confirm the empirically observed scaling law and to predict its variability in agreement with the data. We propose that the natural nutrient variability in food can be quantitatively formalized. This provides a mathematical rationale for imputing missing values in food composition databases and paves the way towards a quantitative understanding of the impact of food processing on nutrient balance and health effects.

### *Category: Post & Long Covid-19 and Nutrients Intakes*

### Dietary Recommendations for Post-COVID-19 Syndrome.

Barrea L, Grant WB, Frias-Toral E, Vetrani C, Verde L, de Alteriis G, Docimo A, Savastano S, Colao A, Muscogiuri G. *Nutrients*. 2022; March 20, 14(6):1305. doi.org/10.3390/nu14061305. **Article link**

**Significance:** A recent review reported many Covid-19 survivors may experience malnutrition, loss of fat-free mass, and low-grade inflammation complicated by recurring impairment (i.e., fatigue and muscle weakness, dysphagia, appetite loss, and taste/smell alterations, and psychological distress). Thus, personalized evaluation of nutritional status is critical to identify potential nutrient and non-nutrient deficiencies, with advice to include foods rich anti-inflammatory and immuno-stimulating activities such as the Mediterranean Diet, supplementation of Vitamin D, Omega-3, Vitamins A, C and E.

At the beginning of the coronavirus disease (COVID-19) pandemic, global efforts focused on containing the spread of the virus and avoiding contagion. Currently, it is evident that health professionals should deal with the overall health status of COVID-19 survivors. Indeed, novel findings have identified post-COVID-19 syndrome, which is characterized by malnutrition, loss of fat-free mass, and low-grade inflammation. In addition, the recovery might be complicated by persistent functional impairment (i.e., fatigue and muscle weakness, dysphagia, appetite loss, and taste/smell alterations) as well as psychological distress. Therefore, the appropriate evaluation of nutritional status (assessment of dietary intake, anthropometrics, and body composition) is one of the pillars in the management of these patients. On the other hand, personalized dietary recommendations represent the best strategy to ensure recovery. Therefore, this review aimed to collect available evidence on the role of nutrients and their supplementation in post-COVID-19 syndrome to provide a practical guideline to nutritionists to tailor dietary interventions for patients recovering from COVID-19 infections.

## Engage with IAFNS

- **IAFNS Annual Meeting & Science Symposium: Advancing Science for Impact**
  **June 21-23, 2022, a hybrid event with online registration still open.**
    - The IAFNS Annual Meeting & Scientific Symposium is a forum for the presentation and discussion of research and ideas—focusing on science with impact. The focus will be on science that supports credible decision making by government regulators, industry professionals and academic researchers. The conference offers an exceptional learning environment and brings together a range of experts, including food and nutrition researchers, healthcare professionals, opinion leaders, industry representatives, government officials, and future leaders. The Keynote address will be delivered by **Dr. Susan Mayne, Director of the Center for Food Safety and Applied Nutrition (CFSAN)** at the US Food and Drug Administration. To register, click **here**.

- **What is 'Sweetness'? The Biological Role of Sweet Taste and Quality of Life for Individuals with Type 1 Diabetes**
  **A July 19, 2022, webinar, 11:00 am – 12:00 pm ET.**
    - The role of sweetness in the context of sensory perception and the total diet is complex, and the ability to change preference for sweet remains under investigation. Given the biological drive for sweet taste, low- and no-calorie sweeteners (LNCSs) have been acknowledged as a tool for reducing the intake of total carbohydrates, and particularly added sugars, in the nutritional management of diabetes. To learn more about this webinar, the CPE credits available, and to register, click **here**.

- **'Crash Course' on Design and Implementation of Microbiome Research**.
  **July 21, 2022, webinar, 2:00-3:00 pm ET.**
    - Effective application of gut microbiome research requires clinicians to critically appraise methodological elements of research when interpreting results. In this webinar, an overview of best practices for designing and conducting diet-microbiome research in humans will be provided. Topics will include not only intervention study designs but also recruitment tips, sampling methods and important metadata to collect. To learn more about this webinar, the CPE credits available and other details, click **here**.