

March 2022

# Nutrition



## Dietary Patterns

### Adherence to Emerging Plant-Based Dietary Patterns and its Association with Cardiovascular Disease Risk in a Nationally Representative Sample of Canadian Adults.

Svilena V Lazarova, Jason M Sutherland, Mahsa Jessri DOI: 10.1093/ajcn/nqac062. *Am J Clin Nutr.* 2022 Mar 10;nqac062. [Article link](#)

**Significance:** Adherence to the plant-based dietary patterns was not associated with CVD risk in a study with Canadian adults. No significant associations were observed between dietary index scores and CVD risk. More research is needed to further evaluate the role of plant-based diets in CVD prevention.



**Background:** Little is known about the role of emerging plant-based dietary patterns in cardiovascular disease (CVD) at the national population level. **Objectives:** The objectives of this research were to assess the validity and reliability of newly-established plant-based dietary indices, and to evaluate their associations with CVD risk among Canadian adults. **Design:** Data were obtained from repeated 24-hour dietary recalls of adult participants in the cross-sectional, nationally representative Canadian Community Health Survey cycle 2004 linked to vital statistics (n=12,323) and cycle 2015 (n=14,026). Plant-based

diet quality was assessed with a revised Plant-based Dietary Index (PDI), EAT-Lancet Reference Diet (ERD) score and the latest Dietary Guidelines for Americans Adherence Index (DGAI) 2020. Weighted multivariate analyses were used for testing associations between diet quality and lifestyle characteristics, and weighted multivariable-adjusted Cox proportional-hazards models for associations with CVD risk. **Results:** Construct validity was confirmed for the revised PDI and DGAI 2020 (but not ERD) as participants in the highest (healthiest) quartile, compared to those in the lowest (least healthy), were more likely to be female (52.63±1.27% compared to 44.8±1.65% for revised PDI; 59.37±2.01% compared to 40.84±1.71% for DGAI 2020), older (50.55±0.39 compared to 45.56±0.43 for revised PDI; 51.57±0.39 compared to 46.35±0.54 for DGAI 2020), to have post-secondary education (32.36±1.55% compared to 21.12±1.31% for revised PDI; 34.17±2.69% compared to 17.87±0.98% for DGAI 2020), and less likely to be daily smokers (8.21±1% compared to 17.06±1.45% for revised PDI; 7.36±1.71% compared to 21.53±1.58% for DGAI 2020) (P-trend<0.0001). No significant associations were observed between dietary index scores and CVD risk. **Conclusions:** Revised PDI and DGAI 2020 provided valid and meaningful measures of plant-based eating among Canadians, while validity of ERD was not directly confirmed. Adherence to the plant-based dietary patterns was not associated with CVD risk. Future large-scale analyses are necessary to further evaluate the role of plant-based eating in CVD prevention.

### Reproducibility and Validity of Diet Quality Scores Derived from Food-Frequency Questionnaires

Yiyang Yue, Changzheng Yuan, Dong D Wang, Molin Wang, Mingyang Song, Zhilei Shan, Frank Hu, Bernard Rosner et. al. *Am J Clin Nutr.* 2022 Mar 4;115(3):843-853. doi: 10.1093/ajcn/nqab368. [Article link](#)

**Significance:** The study confirmed the validity for the use of Food-Frequency Questionnaires (FFQ) to evaluate overall diet quality using 6 commonly used Diet quality scores (DQSs) shown to demonstrate qualitative biological relevance from their correlations with circulating biomarkers.

**Background:** Diet quality scores (DQSs) are frequently used to study diet-disease relations but the validity of these scores derived from FFQs has rarely been evaluated. **Objectives:** To evaluate the validity and reproducibility of 6 commonly used DQSs derived from the FFQ, including the Alternate Healthy Eating Index-2010, Dietary Approaches to Stop Hypertension Trial score, alternative Mediterranean diet score, and 3 plant-based diet indices (overall, healthful,

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and unhealthful). **Methods:** This analysis included 1394 participants from the Men's Lifestyle Validation Study (N = 652) and the Women's Lifestyle Validation Study (N = 742). Participants completed a 152-item FFQ at the beginning of the study and 1 y later, as well as completed 2 weighed 7-d dietary records (7DDR) and donated 2 blood samples 6 mo apart between FFQ assessments. The reproducibility of the FFQs was evaluated by rank intraclass correlation coefficients (ICCs). The validity was assessed by comparing FFQ-derived DQs with those from the average of two 7DDRs using Spearman rank correlation coefficients deattenuated for random measurement error in the 7DDRs (rs). Furthermore, we calculated the correlations between DQs and plasma biomarkers of diet, including fatty acids, folate, carotenoids, retinol, and  $\alpha$ - and  $\gamma$ -tocopherol. **Results:** Six FFQ-derived DQs demonstrated moderate to high reproducibility (energy-adjusted ICCs: 0.61–0.84) and validity (energy-adjusted, deattenuated rs = 0.56–0.80) in both men and women. We consistently observed expected correlations between FFQ-derived DQs with plasma fatty acids, including long-chain n-3 ( $\omega$ -3) and trans fatty acids, most carotenoids, and  $\gamma$ -tocopherol (rs > 0.2). **Conclusions:** Our study demonstrates the validity of the FFQ to evaluate overall diet quality using 6 commonly used DQs. In addition, these DQs have qualitatively demonstrated biological relevance, as indicated by their correlations with circulating biomarkers.

## Carbohydrates

### Intragastric Fructose Administration Interacts with Emotional State in Homeostatic and Hedonic Brain Regions.

Julie Iven, Jessica R Biesiekierski, Dongxing Zhao, Jan Tack, Lukas Van Oudenhove. *Nutr Neurosci*. 2022 Mar;25(3):581-592. doi: 10.1080/1028415X.2020.1781326. [Article link](#)

**Significance:** Interoceptive effect of fructose on emotional state in homeostatic and hedonic regions of the brain was investigated in a study with healthy subjects. No main effects of fructose, emotion, or fructose-by-emotion interaction on emotional ratings were observed. The study found no behavioral level change with 25 gram of fructose intragastric infusion.

**Background:** Interoceptive properties of food may influence emotional state and its neural basis, as shown for fatty acids but remains unstudied for carbohydrates. **Objectives:** To study the effects of fructose and its interaction with sad emotion on brain activity in homeostatic and hedonic regions and investigate whether gut hormone responses can explain effects. **Design:** In 15 healthy subjects, brain activity for 40min after intragastric infusion of fructose (25g) or water was recorded using a cross-over pharmacological magnetic resonance imaging (phMRI) paradigm. Sad or neutral emotional states were induced by classical music and emotional facial expressions. Emotional state was assessed using the Self-Assessment Manikin. Blood samples were taken to assess gut hormone levels. Brain responses to fructose versus placebo, sad versus neutral emotion, and their interaction were analyzed over time in a single mask of a priori defined regions of interest at a voxel-level threshold of  $p_{FWEcorrected} < 0.05$ . Effects on emotion and hormones were tested using linear mixed models. **Results:** No main effects of fructose, emotion, or fructose-by-emotion interaction on emotional ratings were observed. Main effects of fructose, emotion and aninteraction effect were found on brain activity (medulla, midbrain, hypothalamus, basal ganglia, anterior insula, orbitofrontal cortex, anterior cingulate cortex and amygdala). An increase in circulating GLP-1 after fructose in neutral emotion was abolished during sad emotion (fructose-by-emotion-by-time,  $p=0.041$ ). Ghrelin levels were higher in sad emotion (time-by-emotion,  $p=0.037$ ). **Conclusions:** Emotional state interacts with brain and endocrine responses to intragastric infusion of 25 g of fructose, however such an effect was not found at behavioral level.

## Protein

### Perspective: Is it Time to Expand Research on 'Nuts' to Include 'Seeds'? Justifications and Key Considerations

Elena S George, Robin M Daly, Siew Ling Tey, Rachel Brown, Tommy Hon Ting Wong, Sze-Yen Tan. *Adv Nutr*. 2022 Mar 25;nmac028. doi: 10.1093/advances/nmac028. [Article link](#)

**Significance:** This review highlights the need for revisiting current definitions for nuts and seeds, and the need to evaluate differences and similarities in nutrient composition and contributing health benefits of these groups separately and in combination. The report calls for future research to include both epidemiological and interventional study designs.

The health benefits of nuts reported throughout the literature are extensive and well established for reducing the risk of, and managing several chronic conditions including, but not limited to cardiovascular disease, type 2 diabetes, non-alcoholic fatty liver disease, and cognition. Despite their comparable nutritional profile, seeds are often not assessed in clinical and epidemiological studies. Interestingly dietary guidelines and recommendations often refer to 'nuts and seeds' collectively, even though they are not consistently examined together in nutrition research when determining associated health benefits.

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The purpose of this review is to call for future nutrition research to consider combining nuts and seeds. This review provides the justification for this proposal by summarizing current definitions for nuts and seeds and highlighting the similarities or dissimilarities in their nutrient compositions. Following this, we summarize current evidence on the health benefits of nuts and seeds, research gaps that should be addressed, and considerations for future research using both epidemiological and interventional study designs.

## Low- and No-Calorie Sweeteners

### A Novel Multi-Layer Prediction Approach for Sweetness Evaluation Based on Systematic Machine Learning Modeling.

Zheng-Fei Yang, Ran Xiao, Guo-Li Xiong, Qin-Lu Lin, Ying Liang, Wen-Bin Zeng, Jie Dong, Dong-Sheng Cao. *Food Chem.* 2022 March 15, 131249. DOI: 10.1016/j.foodchem.2021.131249. [Article link](#)

**Significance:** Food scientists can now use a novel multi-layer sweetness evaluation system based on machine learning to improve data quality when applied to assessment of sweet properties of different chemical compounds including natural, artificial, carbohydrate, non-carbohydrate, nutritive and non-nutritive ones.



Nowadays, computational approaches have drawn more and more attention when exploring the relationship between sweetness and chemical structure instead of traditional experimental tests. In this work, we proposed a novel multi-layer sweetness evaluation system based on machine learning methods. It can be used to evaluate sweet properties of compounds with different chemical spaces and categories, including natural, artificial, carbohydrate, non-carbohydrate, nutritive and non-nutritive ones, suitable for different application scenarios. Furthermore, it provided quantitative predictions of sweetness. In addition, sweetness-related chemical basis and structure transforming rules were obtained by using molecular cloud and matched molecular pair analysis (MMPA) methods. This work systematically improved the data quality, explored the best machine learning algorithm and molecular characterizing strategy, and finally obtained robust models to establish a multi-layer prediction system (available at: <https://github.com/ifyoungnet/ChemSweet>). We hope that this study could facilitate food scientists with efficient screening and precise development of high-quality sweeteners.

## Cognitive Health

### Plasma Folate Levels in Relation to Cognitive Impairment: A Community-Based Cohort of Older Adults in China

Xiao Chen, Jiayi Yang, Hui Zhang, Yuhui Huang, Yaying Cao, Shiyu Yan, Geng Zong et. al. *Eur J Nutr.* 2022 Mar 18. doi: 10.1007/s00394-022-02825-y. [Article link](#)

**Significance:** A higher level of plasma folate was significantly associated with lower odds of cognitive impairment in a study in adult Chinese males (OR = 0.12, 0.03-0.52), supporting the potential beneficial role of higher plasma folate levels in cognitive function. Future studies with larger sample size and longer follow-up are warranted to confirm these findings and to identify the optimal plasma folate level for cognitive function.

**Purpose:** Lower plasma level of folate has been associated with an increased risk of age-related cognitive impairment. However, studies that examined this relation have yielded mixed results. We aimed to examine the prospective association of plasma folate level with risk of cognitive impairment in a community-based prospective cohort of older adults in China. **Methods:** This study included 615 participants (mean age: 76.3 years) without baseline cognitive impairment from the Rugao Longevity and Ageing Study (RuLAS). We used logistic regression to examine the prospective association between baseline plasma folate and risk of cognitive impairment in the next two years. Fasting blood samples were collected and assayed for plasma folate level at baseline. Cognitive impairment was defined as Hasegawa Dementia Scale (HDS) score  $\leq$  21.5 points. **Results:** During two years' follow-up, 20.7% of the participants developed cognitive impairment. After controlled for age, gender, and plasma homocysteine, a higher level of plasma folate was associated with lower odds of cognitive impairment. The corresponding odds ratio (OR) with 95% confidence interval was 0.41 (0.19-0.89) comparing participants at extreme quintiles of plasma folate (median level 17.2 vs. 6.3 nmol/L). The associations were similar after further adjustment for major demographic and lifestyle factors (OR = 0.42, 0.18-0.98). Moreover, the inverse association was particularly stronger among males (OR = 0.12, 0.03-0.52) but was non-significant among females. **Conclusion:** Our findings support a potential beneficial role of higher plasma folate levels in cognitive function in older Chinese adults, particularly among males. Future studies with larger sample size and longer follow-up are warranted to confirm these findings and to identify the optimal plasma folate level for cognitive function.

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## Lipids

### Dietary Intake and Plasma Concentrations of PUFAs in Childhood and Adolescence in Relation to Asthma and Lung Function up to Adulthood.

Sandra Ekström, Emmanouela Sdona, Susanna Klevebro, Jenny Hallberg, Antonios Georgelis, Inger Kull, Erik Melén et. al. *A Am J Clin Nutr.* 2022 Mar 4;115(3):886-896. doi: 10.1093/ajcn/nqab427. [Article link](#)

**Significance:** High intakes of select dietary n-6 PUFAs during in childhood or adolescence may be associated with increased risk of asthma, in contrast to decreased risk when evaluating data from dietary biomarker of certain plasma n-3 and n-6 PUFAs. Further research is needed to investigation the discrepancy, and to improve dietary preventive strategies for asthma.

**Background:** PUFAs may influence the risk of asthma; however, long-term prospective studies including objective biomarkers of PUFA intake are lacking. **Objectives:** The objective was to investigate the role of dietary intake and plasma concentrations of n-3 and n-6 ( $\omega$ -3 and  $\omega$ -6) PUFAs in childhood and adolescence for the development of asthma and lung function up to young adulthood. **Methods:** The study included participants from the Swedish prospective birth cohort BAMSE. Dietary intake of PUFAs was calculated from FFQs (n = 1992) and plasma proportions of PUFAs were measured in phospholipids (n = 831). We analyzed the n-3 PUFA  $\alpha$ -linolenic acid (ALA; 18:3n-3); the sum of very-long-chain (VLC) n-3 PUFAs: EPA (20:5n-3), DHA (22:6n-3), and docosapentaenoic acid (22:5n-3); and the n-6 PUFAs linoleic acid (LA; 18:2n-6) and arachidonic acid (AA; 20:4n-6). Asthma was assessed by questionnaires at 8, 16, and 24 y and lung function was measured by spirometry at 24 y. **Results:** A high ( $\geq$ median) self-reported dietary intake of LA at 8 y and AA at 16 y was associated with increased risk of prevalent asthma at 24 y (OR: 1.41; 95% CI: 1.10, 1.82 and OR: 1.32; 95% CI: 1.02, 1.70, respectively). In contrast, plasma proportions of ALA,  $\Sigma$ VLC n-3 PUFAs, and AA at 8 y, as well as LA at 16 y, were inversely associated with prevalent asthma at 24 y (e.g., OR: 0.55; 95% CI: 0.38, 0.81 for  $\Sigma$ VLC n-3 PUFAs). No consistent associations were observed with lung function. **Conclusions:** High dietary intake of certain n-6 PUFAs in childhood or adolescence may be associated with increased risk of asthma up to young adulthood, whereas dietary biomarkers of certain n-3 and n-6 PUFAs in plasma may be associated with decreased risk. Thus, the role of diet compared with altered metabolism of PUFAs needs further investigation to improve dietary preventive strategies for asthma.

### Effect of Fat-Reformulated Dairy Food Consumption on Postprandial Flow-Mediated Dilatation and Cardiometabolic Risk Biomarkers Compared with Conventional Dairy: A Randomized Controlled Trial.

Oonagh Markey, Dafni Vasilopoulou, Kirsty E Kliem, Colette C Fagan, Alistair S Grandison, Rachel Sutton, David J Humphries et. al. DOI: 10.1093/ajcn/nqab428. [Article link](#)

**Significance:** This research provides new insights into the longer-term impacts of FA-modified dairy food consumption on postprandial cardiometabolic responses.

**Background:** Longer-term consumption of SFA-reduced, MUFA-enriched dairy products has been reported to improve fasting flow-mediated dilatation (FMD). Yet, their impact on endothelial function in the postprandial state warrants investigation. **Objectives:** The aim was to compare the impact of a fatty acid (FA) modified with a conventional (control) dairy diet on the postprandial %FMD (primary outcome) and systemic cardiometabolic responses to representative meals, and retrospectively explore whether treatment effects differ by apolipoprotein E (APOE) or endothelial NO synthase (eNOS) Glu298Asp gene polymorphisms. **Methods:** In a crossover-design randomized controlled study, 52 adults with moderate cardiovascular disease risk consumed dairy products [38% of total energy intake (%TE) from fat: FA-modified (target: 16%TE SFAs; 14%TE MUFAs) or control (19%TE SFAs; 11%TE MUFAs)] for 12 wk, separated by an 8-wk washout. Blood sampling and FMD measurements (0-480 min) were performed pre- and postintervention after sequential mixed meals that were representative of the assigned dairy diets (0 min, ~50 g fat; 330 min, ~30 g fat). **Results:** Relative to preintervention ( $\Delta$ ), the FA-modified dairy diet and meals (treatment) attenuated the increase in the incremental AUC (iAUC), but not AUC, for the %FMD response observed with the conventional treatment (-135  $\pm$  69% vs. +199  $\pm$  82%  $\times$  min; P = 0.005). The  $\Delta$  iAUC, but not AUC, for the apoB response decreased after the FA-modified treatment yet increased after the conventional treatment (-4  $\pm$  3 vs. +3  $\pm$  3 mg/mL  $\times$  min; P = 0.004). The  $\Delta$  iAUC decreased for plasma total SFAs (P = 0.003) and trans 18:1 (P < 0.0001) and increased for cis-MUFAs (P < 0.0001) following the conventional relative to the FA-modified treatment. No treatment  $\times$  APOE or eNOS genotype interactions were evident for any outcome. **Conclusions:** This study provides novel insights into the longer-term effects of FA-modified dairy food consumption on postprandial cardiometabolic responses.

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## Sodium

### Sodium Intake and Risk of Hypertension: A Systematic Review and Dose-Response Meta-analysis of Observational Cohort Studies

Tommaso Filippini, Marcella Malavolti, Paul K Whelton, Marco Vinceti. *Curr Hypertens Rep.* 2022 Mar 4. doi: 10.1007/s11906-022-01182-9. [Article link](#)

**Significance:** Consistent with prior findings, this systematic review and meta-analysis of cohort studies found a near linear relationship between sodium intake/excretion and hypertension risk.

**Purpose of the review:** To assess the relationship between sodium intake and hypertension risk in cohort studies, based on a systematic review up to January 21, 2022, that also employed a dose-response meta-analysis. **Recent findings:** Dose-response analysis of available cohort studies (n = 11), using a dietary intake or urinary sodium excretion of 2 g/day as the reference category, showed an excess risk starting at 3 g/day. However, we found a linear relationship across the entire range of sodium exposure in an analysis restricted to studies that used 24 h urinary sodium excretion information and had a low risk of bias. This review confirms prior findings based on experimental studies and identified an almost linear relationship between sodium intake/excretion and hypertension risk in cohort studies, reinforcing the validity of recommendations to prevent cardiovascular disease through the reduction of sodium intake in both normotensive and hypertensive adults.

## Gut Microbiome

### Characterizing Patterns of Dietary Exposure Using Metabolomic Profiles of Human Biospecimens: A Systematic Review

Stephanie Andraos, Kathryn Louise Beck, Mary Beatrix Jones, Ting-Li Han, Cathryn Anne Conlon, Jamie Violet de Seymour. *Nutr Rev.* 2022 Mar 10;80(4):699-708. doi: 10.1093/nutrit/nuab103 [Article link](#)

**Significance:** To better understand the diet-disease relationship, metabolomic profiles provides a more comprehensive mapping of a myriad of factors, including diet, genetic, phenotypic, and environmental influences, on the impact of diet on metabolism and health outcomes. The relationship of dietary patterns and metabolomic profiles in different subpopulations needs to be further explored.

**Context:** Establishing diet–disease associations requires reliable assessment of dietary intake. With the rapid advancement of metabolomics, its use in identifying objective biomarkers of dietary exposure has substantially increased. **Objective:** The aim of our review was to systematically combine all observational studies linking dietary intake patterns with metabolomic profiles of human biospecimens. **Data Sources:** Five databases were searched – MEDLINE, Embase, Scopus, Web of Science, and Cochrane CENTRAL – to March 2020. **Data Extraction:** Of the 14 328 studies initially screened, 35 observational studies that met the specified inclusion criteria were included. **Data Analysis:** All reviewed studies indicated that metabolomic measures were significantly correlated with dietary patterns, demonstrating the potential for using objective metabolomic measures to characterize individuals' dietary intake. However, similar dietary patterns did not always result in similar metabolomic profiles across different study populations. **Conclusion:** Metabolomic profiles reflect a multitude of factors, including diet, genetic, phenotypic, and environmental influences, thereby providing a more comprehensive picture of the impact of diet on metabolism and health outcomes. Further exploration of dietary patterns and metabolomic profiles across different population groups is warranted.

### Tree-Based Analysis of Dietary Diversity Captures Associations Between Fiber Intake and Gut Microbiota Composition in a Healthy US Adult Cohort

Mary E Kable, Elizabeth L Chin, David Storms, Danielle G Lemay, Charles B Stephensen. *J Nutr.* 2022 Mar 3;152(3):779-788. doi: 10.1093/jn/nxab430. [Article link](#)

**Significance:** In healthy adults, the tree structure, annotated with grams of carbohydrate, is a robust method for comparing self-reported diet to the gut microbial community composition, demonstrating a link between fruit fiber to gut pectinolytic bacterial genus, *Lachnospira* abundance.

**Background:** Diet patterns are a significant and modifiable contributing factor to the composition of the human gut microbiota. **Objectives:** We set out to identify reproducible relationships between diet and gut microbial community composition in a diverse, healthy US adult cohort. **Methods:** We collected 2 to 3 automated self-administered 24-hour dietary recalls over 10-14 days, together with a single stool sample, from 343 healthy adults in a cross-sectional phenotyping study. This study examined a multi-ethnic cohort balanced for age (18-65 years), sex, and BMI (18.5-45 kg/m<sup>2</sup>). Dietary data were edited to a tree format according to published methods. The tree structure was annotated with the average total grams of dry weight, fat, protein, carbohydrate, or fiber from each food item reported. The alpha and beta

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diversity measurements, calculated using the tree structure, were analyzed relative to the microbial community diversity, determined by a Quantitative Insights Into Microbial Ecology (QIIME) 2 analysis of the bacterial 16S ribosomal RNA V4 region, sequenced from stool samples. K-means clustering was used to form groups of individuals consuming similar diets, and gut microbial communities were compared among groups using differential expression analysis for sequence count data. **Results:** The alpha diversity of diet dry weight was significantly correlated with the gut microbial community alpha diversity ( $r = 0.171$ ). The correlation improved when diet was characterized using grams of carbohydrates ( $r = 0.186$ ) or fiber ( $r = 0.213$ ). *Bifidobacterium* was enriched with diets containing higher levels of total carbohydrate from cooked grains. *Lachnospira*, was enriched with diet patterns containing high consumption of fiber from fruits excluding berries. **Conclusions:** The tree structure, annotated with grams of carbohydrate, is a robust analysis method for comparing self-reported diet to the gut microbial community composition. This method identified consumption of fiber from fruit robustly associated with an abundance of pectinolytic bacterial genus, *Lachnospira*, in the guts of healthy adults.

## Emerging Science Areas

### *Emerging areas: Nutrition*

#### ***Pediatric Nutrition: Impact of Vitamin D Intake on Infant Health, learning from WIC.***

##### **Vitamin D Intake and Meeting Recommendations Among Infants Participating in WIC Nationally.**

Gallo S, Gahche J, Kitsantas P, Makwana P, Wang Y, Chen X, Rajbhandari-Thapa J. *J Nutr Educ Behav* 2022 Mar 11;S1499-4046(21)00939-8. doi: 10.1016/j.jneb.2021.11.009. [Article link](#)

**Significance:** A study of a national sample of WIC infant participants (2013-2015) found current vitamin D recommendation was not met by a high proportion of the population. Future needs may warrant more coordinated approaches among providers in addition to research on clinical impact of low vitamin D intake in infants.

**Objective:** To report and examine associations with infant vitamin D intake and meeting recommendations among a national sample participating in Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). **Design:** Secondary analysis from the 2013-2015 WIC Infant Toddler Feeding Practices Study-2. **Participants:** US Infants. Variables measured: Total reported vitamin D intake from diet and supplementation at the time of data collection. **Analysis:** Descriptive statistics and generalized estimating equations. **Results:** The median total vitamin D intake ranged from 5.43 (95% confidence interval, 5.40-5.46) mcg/d at month 1 to 8.18 (95% confidence interval, 8.11-8.20) mcg/d at month 13, with 16% to 36% of infants meeting the infant vitamin D recommendation over that time. Overall, 6% to 12% of all participants reported supplementation across all time points. Although most (between 78% to 98%) of supplemented breastfed infants met the recommendation, very few were supplemented as a group. Hence, breastfed infants were less likely to meet the recommendation than those who were formula fed across at time points except month 1 ( $P < 0.001$  for all). Whereas infant age, feeding type, and/or their interaction were significant predictors of both receiving supplementation and meeting the recommendation, mother/caregiver nativity ( $P = 0.006$ ) and parity ( $P = 0.01$  and  $P < 0.001$ ) predicted receiving supplementation, and child sex ( $P < 0.001$ ) and mother/caregiver race/ethnicity ( $P < 0.001$ ) predicted meeting the recommendation. **Conclusions and Implications:** Among a national sample of infants participating in WIC between 2013-2015, a high proportion were not meeting the current vitamin D recommendation. The WIC program is 1 resource for promoting strategies for increasing the number of American infants meeting D recommendations, but a coordinated approach involving other health care providers is likely needed. Future research exploring the reason for lack of supplementation, from both the perspective of parents and providers and the clinical impact of low vitamin D intake, is warranted.

#### ***Dietary Supplement/ Food Decisions: Inclusion of dietary supplement in index of measure for assessing nutrients exposure.***

##### **The Total Nutrient Index is a Useful Measure for Assessing Total Micronutrient Exposures Among US Adults.**

Cowan AE, Bailey RL, Jun S, Dodd KW, Gahche JJ, Eicher-Miller HA, Guenther PM, Dwyer JT, Potischman N, Bhadra A, Carroll RJ, Tooze JA. *J Nutr* 2022;152:863-71. 3 March 2022. doi: 10.1093/jn/nxab428. [Article link](#)

**Significance:** Total Nutrient Index is a useful and validated construct for use in assessing intakes of total underconsumed micronutrients including from dietary supplements among US adults.

**Background:** Most dietary indices reflect foods and beverages and do not include exposures from dietary supplements (DS) that provide substantial amounts of micronutrients. A nutrient-based approach that captures total intake inclusive of DS can strengthen exposure assessment. **Objectives:** We examined the construct and criterion validity of the Total Nutrient Index (TNI) among US adults ( $\geq 19$  years; nonpregnant or lactating). **Methods:** The TNI includes 8 underconsumed micronutrients identified by the Dietary Guidelines for Americans: calcium; magnesium; potassium;

choline; and vitamins A, C, D, and E. The TNI is expressed as a percentage of the RDA or Adequate Intake to compute micronutrient component scores; the mean of the component scores yields the TNI score, ranging from 0-100. Data from exemplary menus and the 2003-2006 ( $\geq 19$  years;  $n = 8861$ ) and 2011-2014 NHANES ( $\geq 19$  years;  $n = 9954$ ) were employed. Exemplary menus were used to determine whether the TNI yielded high scores from dietary sources (women, 31-50 years; men  $\geq 70$  years). TNI scores were correlated with Healthy Eating Index (HEI) 2015 overall and component scores for dairy, fruits, and vegetables; TNI component scores for vitamins A, C, D, and E were correlated with respective biomarker data. TNI scores were compared between groups with known differences in nutrient intake based on the literature. **Results:** The TNI yielded high scores on exemplary menus (84.8-93.3/100) and was moderately correlated ( $r = 0.48$ ) with the HEI-2015. Mean TNI scores were significantly different for DS users (83.5) compared with nonusers (67.1); nonsmokers (76.8) compared with smokers (70.3); and those living with food security (76.6) compared with food insecurity (69.1). Correlations of TNI vitamin component scores with available biomarkers ranged from 0.12 ( $\alpha$ -tocopherol) to 0.36 (serum 25-hydroxyvitamin D) and were significantly higher than correlations obtained from the diet alone. **Conclusions:** The evaluation of validity supports that the TNI is a useful construct to assess total micronutrient exposures of underconsumed micronutrients among US adults.

## Engage with IAFNS

- **Understanding Gut Microbiota, COVID-19, and Nutrition: Interactions, Interventions, and Unknowns.** April 21, 2022. 10:00-11:00 am ET.
  - It is well-established that the gut microbiota plays a role in regulating the immune system, including modifying the response to viral infections. In fact, research indicates that the severity of COVID-19 is related in part to the composition of the gut microbiota. How can diet and nutrition support the microbiota-dependent immunoregulatory functions? What do we really know today, and what is under investigation? For more information, click [here](#).
- **Nutrition as a Human Right – Disease Related Malnutrition.** May 5, 2022, pre-conference event. Hybrid, Gatineau (Quebec), Canada – and on-line
  - IAFNS is partnering with the Canadian Nutrition Society and the Canadian Malnutrition Task Force to offer a Food for Health Workshop as a Pre-Conference event immediately preceding the Canadian Nutrition Society meeting. For more information, click [here](#).
- **GS1 Connect 2022.** June 7–9, 2022. San Diego, CA.
  - IAFNS is representing the Partnership on the USDA Global Branded Food Products Database at GS1 Connect 2022. This event brings trading partners together to learn about standards-based business processes and best practices for optimum efficiencies in managing the supply and demand sides of their value chain. IAFNS' presentation will focus on sharing data within the USDA Branded Food Product Database. For more information, click [here](#).
- **IAFNS Annual Meeting & Science Symposium: Advancing Science for Impact.** June 21-23, 2022, At the National Press Club in Washington DC.
  - 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](#).

