

July 2021

Nutrition Briefs

USDA Global Branded Food Products Database

Perspective: Plant-Based Eating Pattern for Type 2 Diabetes Prevention and Treatment: Efficacy, Mechanisms, and Practical Considerations

Here, we feature articles that leverage data in the USDA Global Branded Food Products Database. IAFNS is a partner in the Public-Private Partnership on the USDA Global Branded Food Products Database.

Contact science@iafns.org for more information on using or submitting your products to the Database.



Perspective: Identifying Ultra-Processed Plant-Based Milk Alternatives in the USDA Branded Food Products Database.

Drewnowski A. *Advances in Nutrition*, 21 July, nmabo89, doi.org/10.1093/advances/nmabo89. [Article link](#)

Significance: Analysis of data obtained from the USDA Branded Food Data Base identified 641 nondairy plant-based beverages, with most (over 90%) meeting the NOVA criteria for ultra-processed foods. Substituting dairy drinks and products with plant-based alternatives will involve the use of ultra-processed foods.

This study explored the characteristics of plant-based beverages (PBBs) that are marketed as “milks” in the United States. First, machine searches of product names and ingredients in the USDA Branded Food Products Database (BFPDB) yielded 641 different nondairy PBBs that included almond, soy, coconut, cashew, other tree nut, flax/hemp, pea, and quinoa and rice “milks.” The products varied in energy density and the majority of PBBs contained added salt (69%) and added sugar (53%). Scores on nutrient density metrics [Nutri-Score, Choices, and the Nutrient Rich Food index 7.3 (NRF7.3)] were higher for almond and pea products and lower for coconut PBBs, which contained saturated fat. Ingredient lists were searched further for added flavors, stabilizers, or preservatives said to be characteristic of the NOVA food classification system’s ultra-processed group. Most PBBs (90.1%) and 95% of almond milks met the NOVA criteria for ultra-processed foods, because they were created from food components and contained multiple substances not used in normal cooking. Replacing milk and dairy products with plant-based alternatives will necessarily involve the use of ultra-processed foods.

Dietary Proteins

Demographic, Spatial and Temporal Dietary Intake Patterns Among 526,774 23andMe Research Participants.

Shelton JF, Cameron B, Aslibekyan S, 23andMe Research Team; Gentleman R. *Public Health Nutr.* 2021 Jul;24(10):2952-2963. doi: 10.1017/S1368980020001251. [Article link](#)

Significance: This research program offers access to data from hundreds of thousands of subjects, creating an opportunity for large-scale nutrition information collection from broad geographical areas of the US.

Objective: To characterise dietary habits, their temporal and spatial patterns and associations with BMI in the 23andMe study population. **Design:** We present a large-scale cross-sectional analysis of self-reported dietary intake data derived from the web-based National Health and Nutrition Examination Survey 2009-2010 dietary screener. Survey-weighted estimates for each food item were characterised by age, sex, race/ethnicity, education and BMI. Temporal patterns were plotted over a 2-year time period, and average consumption for select food items was mapped by state. Finally, dietary intake variables were tested for association with BMI. **Setting:** US-based adults 20-85 years of age participating in the 23andMe research program. **Participants:** Participants were 23andMe customers who consented to participate in research (n 526 774) and completed web-based surveys on demographic and dietary habits. **Results:** Survey-weighted estimates show



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very few participants met federal recommendations for fruit: 2.6 %, vegetables: 5.9 % and dairy intake: 2.8 %. Between 2017 and 2019, fruit, vegetables and milk intake frequency declined, while total dairy remained stable and added sugars increased. Seasonal patterns in reporting were most pronounced for ice cream, chocolate, fruits and vegetables. Dietary habits varied across the USA, with higher intake of sugar and energy dense foods characterising areas with higher average BMI. In multivariate-adjusted models, BMI was directly associated with the intake of processed meat, red meat, dairy and inversely associated with consumption of fruit, vegetables and whole grains. **Conclusions:** 23andMe research participants have created an opportunity for rapid, large-scale, real-time nutritional data collection, informing demographic, seasonal and spatial patterns with broad geographical coverage across the USA.

Proteins

Replacement of Animal Proteins in Food: How to Take Advantage of Nutritional and Gelling Properties of Alternative Protein Sources.

Floret C, Monnet AF, Micard V, Walrand S, Michon C. *Crit Rev Food Sci Nutr.* 2021 Jul 26;1-27. doi: 10.1080/10408398.2021.1956426. [Article link](#)

Significance: Increasing interest in plant proteins has led to proposal to expand indexes for determining quality besides EAA such as physical-chemical changes during processing e.g textural changes as measured by protein gelation.

Given the growing world population, there is a need to balance animal and vegetable sources of dietary protein and to limit overall protein resources, and food formulation has to consider alternative protein sources as a way to meet human requirements. The protein concentration, essential amino acids (EAA) of all protein sources were analyzed with respect to human needs along with additional macronutrients of nutritional and energy interest (i.e. carbohydrates and lipids). New indexes are proposed to classify the alternative protein sources considering their EAA balance and how it may change during food processing. A global overview of all protein sources is provided including the quantity of food and associated caloric intakes required to fulfill our daily protein needs. As texture is a key parameter in food formulation, and is often influenced by protein gelation, we conducted an exhaustive review of the literature in a large scientific database on the ability of proteins from all sources to go through the sol-gel transition with the corresponding physical-chemical conditions. Traditional and innovative recipes are discussed and some improvements are proposed in terms of their ability to fulfill human needs for EAA and food and caloric intakes.

Long-Term Dietary Protein Intake and Subjective Cognitive Decline in US Men and Women.

Yuan C, Ascherio A, Rosner BA, Blacker D, Willett WC. *Am J Clin Nutr.* 2021 Jul 22; nqab236. doi: 10.1093/ajcn/nqab236. [Article link](#)

Significance: Higher protein intake was linked with lower odds of subjective cognitive declines when compared isocalorically with carbohydrate. Plant protein sources were also associated with lower odds of protein declines when compared with animal protein sources..

Background: Diet is one of the modifiable risk factors for cognitive decline. However, studies on dietary protein intake and cognitive decline have remained limited and inconclusive. **Objectives:** In this study, we aimed to investigate the associations between long-term dietary protein intake and subsequent subjective cognitive decline (SCD). **Methods:** We included 49,493 women from the Nurses' Health Study (NHS) (1984-2006) and 27,842 men from the Health Professionals Follow-up Study (HPFS) (1986-2002). For the NHS, average dietary intake was calculated from 7 repeated semi-quantitative FFQs (SFFQs), and SCD was assessed in 2012 and 2014. For the HPFS, average dietary intake was calculated from 5 repeated SFFQs, and SCD was assessed in 2008 and 2012. Poisson regression was used to examine the associations between dietary protein, amino acids, and various protein food sources with subsequent SCD. **Results:** Higher protein intake compared with total carbohydrates was associated with lower odds of SCD. When substituting 5% energy from protein for the equivalent percentage of energy from total carbohydrates, the pooled multivariable-adjusted ORs (95% CIs) were 0.89 (0.85, 0.94) for total protein, 0.89 (0.84, 0.94) for animal protein, and 0.74 (0.62, 0.88) for plant protein. When substituting 5% of energy from animal protein with plant protein, the OR was 0.84 (95% CI: 0.72, 0.97). For protein food sources, higher intakes of beans/legumes, fish, and lean poultry were significantly associated with lower odds of SCD, but higher intake of hotdogs was associated with higher odds of SCD. **Conclusions:** Higher protein intake was associated with lower odds of SCD when compared isocalorically with carbohydrate. Plant protein sources were also associated with lower odds when compared with animal protein sources. Our findings suggest that adequate protein intake, and choices of protein sources could play a role in the maintenance of cognition and should be studied further.

Lipids

Impact of Low-Fat and Full-Fat Dairy Foods on Fasting Lipid Profile and Blood Pressure: Exploratory Endpoints of a Randomized Controlled Trial.

Schmidt KA, Cromer G, Burhans MS, Kuzma JN, Hagman DK, Fernando I, Murray M, et. al. *Am J Clin Nutr.* 2021 Jul 13;nqab131. doi: 10.1093/ajcn/nqab131. [Article link](#)

Significance: A study in adults with metabolic syndrome found no adverse impacts on fasting blood lipids and blood pressure after a 12-week diet rich in full-fat dairy compared to one limited in dairy or rich in low-fat dairy.

Background: Dietary guidelines traditionally recommend low-fat dairy because dairy's high saturated fat content is thought to promote cardiovascular disease (CVD). However, emerging evidence indicates that dairy fat may not negatively impact CVD risk factors when consumed in foods with a complex matrix. **Objective:** The aim was to compare the effects of diets limited in dairy or rich in either low-fat or full-fat dairy on CVD risk factors. **Methods:** In this randomized controlled trial, 72 participants with metabolic syndrome completed a 4-wk run-in period, limiting their dairy intake to ≤ 3 servings/wk of nonfat milk. Participants were then randomly assigned to 1 of 3 diets, either continuing the limited-dairy diet or switching to a diet containing 3.3 servings/d of either low-fat or full-fat milk, yogurt, and cheese for 12 wk. Exploratory outcome measures included changes in the fasting lipid profile and blood pressure. **Results:** In the per-protocol analysis ($n = 66$), there was no intervention effect on fasting serum total, LDL, and HDL cholesterol; triglycerides; free fatty acids; or cholesterol content in 38 isolated plasma lipoprotein fractions ($P > 0.1$ for all variables in repeated-measures ANOVA). There was also no intervention effect on diastolic blood pressure, but a significant intervention effect for systolic blood pressure ($P = 0.048$), with a trend for a decrease in the low-fat dairy diet (-1.6 ± 8.6 mm Hg) compared with the limited-dairy diet ($+2.5 \pm 8.2$ mm Hg) in post hoc testing. Intent-to-treat results were consistent for all endpoints, with the exception that systolic blood pressure became nonsignificant ($P = 0.08$). **Conclusions:** In men and women with metabolic syndrome, a diet rich in full-fat dairy had no effects on fasting lipid profile or blood pressure compared with diets limited in dairy or rich in low-fat dairy. Therefore, dairy fat, when consumed as part of complex whole foods, does not adversely impact these classic CVD risk factors.

Medium-Chain Triglyceride Oil and Blood Lipids: A Systematic Review and Meta-Analysis of Randomized Trials.

McKenzie KM, Lee CM, Mijatovic J, Haghghi MM, Skilton MR. *J Nutr.* 2021 Jul 13;nxab220. doi: 10.1093/jn/nxab220. [Article link](#)

Significance: MCT oil intake does not increase total cholesterol, LDL cholesterol, or HDL cholesterol levels, but does cause a small increase in triglycerides as reported in a meta-analysis of randomized controlled trials.

Background: Dietary saturated fat raises total cholesterol and LDL cholesterol levels. It is unclear whether these effects differ by the fatty acid chain lengths of saturated fats; particularly, it is unclear whether medium-chain fatty acids increase lipid levels. **Objectives:** We conducted a systematic review to determine the effects of medium-chain triglyceride (MCT) oil, consisting almost exclusively of medium-chain fatty acids (6:0-10:0), on blood lipids. **Methods:** We searched Medline and Embase through March 2020 for randomized trials with a minimum 2-week intervention period that compared MCT oil with another fat or oil. Outcomes were total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels. Included studies were restricted to adults above 18 years of age. Studies conducted in populations receiving enteral or parenteral nutrition were excluded. Data were pooled using a random-effects meta-analysis. **Results:** Seven articles were included in the meta-analysis; LDL cholesterol and HDL cholesterol were reported in 6 studies. MCT oil intake did not affect total cholesterol (0.04 mmol/L; 95% CI, -0.11 to 0.20; $I^2 = 33.6\%$), LDL cholesterol (0.02 mmol/L; 95% CI, -0.13 to 0.17; $I^2 = 28.7\%$), or HDL cholesterol (-0.01 mmol/L; 95% CI, -0.10 to 0.09; $I^2 = 74.1\%$) levels, but did increase triglycerides (0.14 mmol/L; 95% CI, 0.01-0.27; $I^2 = 42.8\%$). Subgroup analyses showed that the effects of MCT oil on total cholesterol and LDL cholesterol differed based on the fatty acid profile of the control oil (Pinteraction = 0.003 and 0.008, respectively), with MCT oil increasing total cholesterol and LDL cholesterol when compared to a comparator consisting predominantly of unsaturated fatty acids, and with some evidence for reductions when compared to longer-chain SFAs. **Conclusions:** MCT oil does not affect total cholesterol, LDL cholesterol, or HDL cholesterol levels, but does cause a small increase in triglycerides.

Carbohydrates

Effects of Whole Grain Intake, Compared with Refined Grain, on Appetite and Energy Intake: A Systematic Review and Meta-Analysis.

Sanders LM, Zhu Y, Wilcox ML, Koecher K, Maki KC. *Advances in Nutrition*, Vol. 12, Issue 4, 2 July 2021, Pages 1177–1195, doi.org/10.1093/advances/nmaa178. [Article link](#)

Significance: Consumption of whole grain (WG) foods, compared with refined grain foods, significantly impacts subjective appetite and may help explain inverse associations between WG food intake and risk of overweight, obesity and weight gain over time.

Results from observational studies indicate that whole grain (WG) intake is inversely associated with BMI and risk of weight gain. WG intake may influence energy balance and body composition through effects on appetite and energy intake. To evaluate the impact of WG food consumption on appetite and energy intake, a systematic review and meta-analysis was performed of results from randomized controlled trials (RCTs) assessing WG food consumption, appetite, and energy intake in adults. A search of PubMed, Scopus, and Food Science and Technology Abstracts yielded 36 RCTs measuring subjective appetite ratings after consuming WG foods compared with refined grain (RG) controls. Thirty-two of these studies reported AUCs for subjective appetite (hunger, fullness, satiety, desire to eat, or prospective consumption) and/or energy intake and were included in the meta-analysis. Pooled estimates from meta-analyses are expressed as standardized mean differences (SMDs). Compared with RG foods, intake of WG foods resulted in significant differences in AUCs for subjective hunger (SMD: -0.34 ; 95% CI: $-0.46, -0.22$; $P < 0.001$), fullness (SMD: 0.49 ; 95% CI: $0.31, 0.66$; $P < 0.001$), satiety (SMD: 0.33 ; 95% CI: $0.18, 0.47$; $P < 0.001$), and desire to eat (SMD: -0.33 ; 95% CI: $-0.46, -0.20$; $P < 0.001$). There were small, nonsignificant reductions in prospective consumption ratings ($P = 0.08$) and energy intake ($P = 0.07$) with WG intake compared with RG. These results support the view that consumption of WG foods, compared with RG foods, significantly impacts subjective appetite, and might partly explain the inverse associations between WG food intake and risk of overweight, obesity, and weight gain over time.

Low- and No-Calorie Sweeteners

The Role of Metabolites of Steviol Glycosides and their Glucosylated Derivatives against Diabetes-Related Metabolic Disorders.

Li Y, Zhu W, Cai J, Liu W, Akihisa T, Li W, Kikuchi T, et. al. *Food Funct.* 2021 Jul 28. doi: 10.1039/d1fo01370j. [Article link](#)

Significance: A recent review concluded that both SGs and GSGs may be suitable as sucrose alternatives and/or pharmacological alternatives for controlling diabetes. Metabolites of SGs and GSGs, such as steviol and steviol glucuronide (SVG), could modulate diabetes related metabolic dysfunction via several ways including anti-hyperglycemic effects, and amelioration of inflammatory response, lipid imbalance, myocardial fibrosis and renal functions.

Diabetes mellitus (DM), characterized by abnormal carbohydrate, lipid, and protein metabolism, is a metabolic disorder caused by a shortage of insulin secretion or decreased sensitivity of target cells to insulin. In addition to changes in lifestyle, a low-calorie diet is recommended to reduce the development of DM. Steviol glycosides (SGs), as natural sweeteners, have gained attention as sucrose alternatives because of their advantages of high sweetness and being low calorie. Most SGs with multiple bioactivities are beneficial to regulate physiological functions. Though SGs have been widely applied in food industry, there is little data on their glucosylated derivatives that are glucosylated steviol glycosides (GSGs). In this review, we have discussed the metabolic fate of GSGs in contrast to SGs, and the molecular mechanisms of glycoside metabolites against diabetes-related metabolic disorders are also summarized. SGs are generally extracted from the Stevia leaf, while GSGs are mainly manufactured using enzymes that transfer glucose units from a starch source to SGs. Results from this study suggest that SGs and GSGs share same bioactive metabolites, steviol and steviol glucuronide (SVG), which exhibit anti-hyperglycemic effects by activating glucose-induced insulin secretion to enhance pancreatic β -cell function. In addition, steviol and SVG have been found to ameliorate the inflammatory response, lipid imbalance, myocardial fibrosis and renal functions to modulate diabetes-related metabolic disorders. Therefore, both SGs and GSGs may be used as potential sucrose alternatives and/or pharmacological alternatives for preventing and treating metabolic disorders.

Bioactives

Long-term Dietary Flavonoid Intake and Subjective Cognitive Decline in US Men and Women.

Yeh TS, Yuan C, Ascherio A, Rosner B, Willett W, Blacker D. *Neurology*. 28 July, 2021, DOI: <https://doi.org/10.1212/WNL.0000000000012454>. [Article link](#)

Significance: Learnings from a large prospective study found benefit of higher flavonoid intakes for maintaining cognitive function in US men and women. The dose-response curve was steepest for flavones, followed by anthocyanins. Strawberries, oranges, grapefruits, citrus juices, apples/pears, celery, peppers and bananas were significantly associated with lower odds of subjective cognitive decline.

Objective: To prospectively examine the associations between long-term dietary flavonoids and subjective cognitive decline (SCD). **Methods:** We followed 49,493 women from the Nurses' Health Study (NHS) (1984-2006) and 27,842 men from the Health Professionals Follow-up Study (HPFS) (1986-2002). Poisson regression was used to evaluate the associations between dietary flavonoids (flavonols, flavones, flavanones, flavan-3-ols, anthocyanins, polymeric flavonoids, and proanthocyanidins) and subsequent SCD. For the NHS, long-term average dietary intake was calculated from seven repeated food frequency questionnaires (SFFQs), and SCD was assessed in 2012 and 2014. For the HPFS, average dietary intake was calculated from five repeated SFFQs, and SCD assessed in 2008 and 2012. **Results:** Higher intake of total flavonoids was associated with lower odds of SCD after adjusting for age, total energy intake, major non-dietary factors, and specific dietary factors. Comparing the highest versus the lowest quintiles of total flavonoid intake, the pooled multivariable-adjusted odds ratios (ORs) (95% CIs) of 3-unit increments in SCD was 0.81 (0.76, 0.89). In the pooled results, the strongest associations were observed for flavones (OR=0.62 [0.57, 0.68]), flavanones (0.64 [0.58, 0.68]), and anthocyanins (0.76 [0.72, 0.84]) (p trend <0.0001 for all groups). The dose-response curve was steepest for flavones, followed by anthocyanins. Many flavonoid-rich foods, such as strawberries, oranges, grapefruits, citrus juices, apples/pears, celery, peppers, and bananas, were significantly associated with lower odds of SCD. **Conclusion:** Our findings support a benefit of higher flavonoid intakes for maintaining cognitive function in US men and women.

Sodium

Potassium Chloride-Based Replacers: Modeling Effects on Sodium and Potassium Intakes of the US Population with Cross-Sectional Data from NHANES 2015–2016 and 2009–2010.

Scrafford CB, Barraj LM, Bi X, Higgins KA, Jaykus LA, Tran NL. *The American Journal of Clinical Nutrition*, Volume 114, Issue 1, July 2021, Pages 220–230, doi.org/10.1093/ajcn/nqab020. [Article link](#)

Significance: Replacement of added sodium chloride (NaCl) with potassium chloride (KCl) in top-ranking sources of dietary sodium provides a potential strategy to reduce US sodium intake to a level consistent with the short-term intake goal identified by FDA, with the mean potassium intake remaining in the range recommended for the apparently healthy population.



This work was supported by the IAFNS [Sodium Committee](#)

Background: Sodium intake in the USA exceeds recommendations. The replacement of added sodium chloride (NaCl) with potassium chloride (KCl) provides a potential strategy to reduce sodium intake. **Objective:** The purpose of this study was to quantitatively estimate changes in intakes of sodium and potassium by the US population assuming use of potassium-based NaCl replacers in top dietary sodium sources. **Methods:** Data collected in the What We Eat in America (WWEIA) component of the 2015–2016 and 2009–2010 NHANES were used to identify top-ranking sources of dietary sodium among the population aged 2 y and older based on contributions from food categories aligning with the FDA draft guidance for voluntary sodium reduction. Predicted nutrient intakes were estimated in models assuming total and feasible and practical (F&P) replacement of added NaCl with KCl in foods and ingredients within the top food sources of sodium. An expert elicitation was conducted to collect information on the F&P KCl replacement of added NaCl. **Results:** Using 2015–2016 consumption data, the total replacement of added NaCl with KCl in the 18 top-ranking sources of dietary sodium results in a predicted sodium intake of 2004 mg/d from the replacement of 1406 mg/d sodium with 1870 mg/d potassium as KCl. Modeled F&P replacement predicted sodium intakes of 3117 mg/d (range of 2953 to 3255 mg/d) from the replacement of 294 mg/d sodium (155 to 457 mg/d) with 390 mg/d potassium (206 to 608 mg/d). Similar results are seen with 2009–2010 data. **Conclusions:** The F&P replacement of NaCl with KCl in top-ranking sources of dietary sodium modeled in this study can result in decreased sodium to a level consistent with the short-term intake goal targeted by the FDA of 3000 mg/d, with the mean potassium intake remaining in the range recommended for the apparently healthy population.

Sodium and Potassium Intake, the Sodium to Potassium Ratio, and Associated Characteristics in Older Adults, NHANES 2011-2016.

Vaudin A, Wambogo E, Moshfegh AJ, Sahyoun NR. *J Acad Nutr Diet*. 2021 Jul 21;S2212-2672(21)00412-3. doi: 10.1016/j.jand.2021.06.012. [Article link](#)

Significance: More than 70 % of US men and women failed to meet current guideline of sodium intake at or below 2300 mg/day. The study using the NHANES survey, found that a higher Na:K ratio was significantly associated with established risk factors for cardiovascular disease, suggesting that more research on cardiovascular health need to include both sodium and potassium intakes.

Background: Sodium, potassium, and the balance between these 2 nutrients are associated with hypertension and cardiovascular disease, and prevalence of these conditions increases with age. However, limited information is available on these intakes among older adults. **Objective:** Our aim was to explore the socioeconomic and health factors associated with usual sodium and potassium intakes and the sodium to potassium (Na:K) ratio of older adults. **Design:** This was a cross-sectional, secondary analysis of the 2011-2012, 2013-2014, and 2015-2016 National Health and Nutrition Examination Survey. **Participants/setting:** This study included the data of 5,104 adults 50 years and older, with at least one reliable 24-hour dietary recall and an estimated glomerular filtration rate ≥ 60 mL/min/1.73 m². **Main outcome measures:** Sodium and potassium intake, as absolute intake, density (per 1,000 kcal) and ratio of Na:K intake. **Statistical analyses:** We used t tests and χ^2 tests to examine significant differences in intakes on a given day by characteristics. Linear and logistic regression models were used to assess associations of socioeconomic and health characteristics with usual sodium and potassium intakes, determined using the National Cancer Institute method. **Results:** Only 26.2% of participants consumed <2,300 mg sodium (16.2% of men and 35.2% of women) and 36.0% of men and 38.1% of women consumed at least 3,400 mg and 2,600 mg of potassium, respectively. Fewer than one-third of participants consumed a Na:K ratio of <1.0. Women, those with lower blood pressure, and those with a lower body mass index were more likely to have a ratio <1.0. **Conclusions:** Participants consumed too much sodium and not enough potassium, based on current recommendations. A higher Na:K ratio was significantly associated with established risk factors for cardiovascular disease. The study findings suggest that more research on cardiovascular health should include both sodium and potassium, as well as balance between these nutrients.

Gut Microbiome

The Gut Microbiome Is Associated with Circulating Dietary Biomarkers of Fruit and Vegetable Intake in a Multiethnic Cohort.

Frankenfeld CL, Hullar MAJ, Maskarinec G, Monroe KR, Shepherd JA, Franke AA, et. al. *J Acad Nutr Diet*. 2021 Jul 2;S2212-2672(21)00373-7. doi: 10.1016/j.jand.2021.05.023. [Article link](#)

Significance: Objective biomarkers of fruit and vegetable intake, particularly carotenoids, were favorably associated with gut bacterial composition and diversity in this multiethnic population. These data support evidence that fruit and vegetable intake impacts gut bacterial ecology.

Background: Results from observational studies suggest high diet quality favorably influences the human gut microbiome. Fruit and vegetable consumption is often a key contributor to high diet quality. **Objective:** To evaluate measures of gut bacterial diversity and abundance in relation to serum biomarkers of fruit and vegetable intake. **Design:** Secondary analysis of cross-sectional data. **Participants and setting:** Men and women from Los Angeles, CA, and Hawai'i who participated in the Multiethnic Cohort-Adiposity Phenotype Study from 2013 to 2016 (N = 1,709). **Main outcome measures:** Gut microbiome diversity and composition in relation to dietary biomarkers. **Statistical analysis:** Carotenoid (beta carotene, alpha carotene, cryptoxanthins, lutein, lycopene, and zeaxanthin), tocopherol (α , β + γ , and δ), and retinol concentrations were assessed in serum. The α and β diversity and composition of the gut microbiome were classified based on 16S rRNA gene sequencing of bacterial DNA from self-collected fecal samples. Global differences in microbial community profiles in relation dietary biomarkers were evaluated using multivariable permutational analysis of variance. Associations of α diversity (Shannon index), β diversity (weighted and unweighted UniFrac) with center log-ratio-transformed phyla and genera abundances were evaluated using linear regression, adjusted for covariates. **Results:** Increasing total carotenoid, beta carotene, alpha carotene, cryptoxanthin, and lycopene concentrations were associated with higher gut bacterial diversity (Shannon Index) ($P < 0.001$). Total tocopherol, α -tocopherol, and δ -tocopherol concentrations contributed significantly to more than 1% of the microbiome variation in gut bacterial community: total tocopherol: 1.74%; α -tocopherol: 1.70%; and δ -tocopherol: 1.16% ($P < 0.001$). Higher total carotenoid was associated with greater abundance of some genera relevant

particularly carotenoids, were favorably associated with gut bacterial composition and diversity in this multiethnic population. These observations provide supportive evidence that fruit and vegetable intake is related to gut bacterial composition; more work is needed to elucidate how this influences host health.