**Nutrition Research Methodology**

**Best (but Oft-Forgotten) Practices: Identifying and Accounting for Regression to the Mean in Nutrition and Obesity Research**


**Significance:** The identification of regression to the mean and implementation of proper statistical practices will help advance the field by improving scientific rigor, and conclusions, especially in intervention studies.

Regression to the mean (RTM) is a statistical phenomenon where initial measurements of a variable in a nonrandom sample at the extreme ends of a distribution tend to be closer to the mean upon a second measurement. Unfortunately, failing to account for the effects of RTM can lead to incorrect conclusions on the observed mean difference between the 2 repeated measurements in a nonrandom sample that is preferentially selected for deviating from the population mean of the measured variable in a particular direction. Study designs that are susceptible to misattributing RTM as intervention effects have been prevalent in nutrition and obesity research. This field often conducts secondary analyses of existing intervention data or evaluates intervention effects in those most at risk (i.e., those with observations at the extreme ends of a distribution). To provide best practices to avoid unsubstantiated conclusions as a result of ignoring RTM in nutrition and obesity research, we outlined best practices for identifying whether RTM is likely to be leading to biased inferences, using a flowchart that is available as a web-based app at: [https://dustyturner.shinyapps.io/DecisionTreeMeanRegression/](https://dustyturner.shinyapps.io/DecisionTreeMeanRegression/). We also provided multiple methods to quantify the degree of RTM. Investigators can adjust analyses to include the RTM effect, thereby plausibly removing its biasing influence on estimating the true intervention effect. The identification of RTM and implementation of proper statistical practices will help advance the field by improving scientific rigor and the accuracy of conclusions. This trial was registered at clinicaltrials.gov as [NCT00427193](https://clinicaltrials.gov/ct2/show/NCT00427193).

**Dietary Patterns**

**Effects of Popular Diets on Anthropometric and Cardiometabolic Parameters: An Umbrella Review of Meta-Analyses of Randomized Controlled Trials**


**Significance:** Among all the diets evaluated, the Mediterranean diet had the strongest and most consistent evidence of a beneficial effect.

The prevalence of overweight, obesity, and their related complications is increasing worldwide. The purpose of this umbrella review was to summarize and critically evaluate the effects of different diets on anthropometric parameters and cardiometabolic risk factors. Medline, Embase, Scopus, Cochrane Database of Systematic Reviews, and Web of Science, from inception to April 2019, were used as data sources to select meta-analyses of randomized controlled trials that examined the effects of different diets on anthropometric parameters and cardiometabolic risk factors. Strength and validity of the evidence were assessed through a set of predefined criteria. Eighty articles reporting 495 unique meta-analyses were examined, covering a wide range of popular diets: low-carbohydrate (n = 21 articles), high-protein (n = 8), low-fat (n = 9), paleolithic (n = 2), low-glycemic-index/load (n = 12), intermittent energy restriction (n = 6), Mediterranean (n = 11), Nordic (n = 2), vegetarian...
(n = 9), Dietary Approaches to Stop Hypertension (DASH) (n = 6), and portfolio dietary pattern (n = 1). Great variability in terms of definition of the intervention and control diets was observed. The methodological quality of most articles (n = 65; 81%), evaluated using the “A MeaSurement Tool to Assess systematic Reviews-2” questionnaire, was low or critically low. The strength of evidence was generally weak. The most consistent evidence was reported for the Mediterranean diet, with suggestive evidence of an improvement in weight, BMI, total cholesterol, glucose, and blood pressure. Suggestive evidence of an improvement in weight and blood pressure was also reported for the DASH diet. Low-carbohydrate, high-protein, low-fat, and low-glycemic-index/load diets showed suggestive and/or weak evidence of a reduction in weight and BMI, but contrasting evidence for lipid, glycemic, and blood pressure parameters, suggesting potential risks of unfavorable effects. Evidence for paleolithic, intermittent energy restriction, Nordic, vegetarian, and portfolio dietary patterns was graded as weak. Among all the diets evaluated, the Mediterranean diet had the strongest and most consistent evidence of a beneficial effect on both anthropometric parameters and cardiometabolic risk factors. This review protocol was registered at www.crd.york.ac.uk/PROSPERO/ as CRD42019126103.

Protein

Protein Type, Protein Dose, and Age Modulate Dietary Protein Digestion and Phenylalanine Absorption Kinetics and Plasma Phenylalanine Availability in Humans


Significance: The findings from this study demonstrate that several factors influence the postprandial muscle protein synthetic response in humans.

Dietary protein ingestion stimulates muscle protein synthesis by providing amino acids to the muscle. The magnitude and duration of the postprandial increase in muscle protein synthesis rates are largely determined by dietary protein digestion and amino acid absorption kinetics. We assessed the impact of protein type, protein dose, and age on dietary protein digestion and amino acid absorption kinetics in vivo in humans. We included data from 18 randomized controlled trials with a total of 602 participants [age: 53 ± 23 y; BMI (kg/m2): 24.8 ± 3.3] who consumed various quantities of intrinsically [1-13C]-phenylalanine-labeled whey (n = 137), casein (n = 393), or milk (n = 72) protein and received intravenous infusions of [ring-2H5]-phenylalanine, which allowed us to assess protein digestion and phenylalanine absorption kinetics and the postprandial release of dietary protein-derived phenylalanine into the circulation. The effect of aging on these processes was assessed in a subset of 82 young (aged 22 ± 3 y) and 83 older (aged 71 ± 5 y) individuals. A total of 50% ± 14% of dietary protein-derived phenylalanine appeared in the circulation over a 5-h postprandial period. Casein ingestion resulted in a smaller (45% ± 11%), whey protein ingestion in an intermediate (57% ± 10%), and milk protein ingestion in a greater (65% ± 13%) fraction of dietary protein-derived phenylalanine appearing in the circulation (P < 0.001). The postprandial availability of dietary protein-derived phenylalanine in the circulation increased with the ingestion of greater protein doses (P < 0.05). Protein digestion and phenylalanine absorption kinetics were attenuated in older when compared with young individuals, with 45% ± 10% vs. 51% ± 14% of dietary protein-derived phenylalanine appearing in the circulation, respectively (P = 0.001). Protein type, protein dose, and age modulate dietary protein digestion and amino acid absorption kinetics and subsequent postprandial plasma amino acid availability in vivo in humans.

Comparison of Methods Used to Correct Self-Reported Protein Intake for Systematic Variation in Reported Energy Intake Using Quantitative Biomarkers of Dietary Intake


Significance: Energy adjustment alone does not eliminate all self-reported protein reporting bias.

Multiple methods of correcting nutrient intake for misreported energy intake have been proposed but have not been extensively compared. The availability of the Women’s Health Initiative (WHI) data set, which includes several objective recovery biomarkers, offers an opportunity to compare these corrections with respect to protein intake. We compared 5 energy-correction methods for self-reported dietary protein against urinary nitrogen-derived protein intake. As part of the WHI Nutritional Biomarkers Study (NBS) 544 participants (50- to 80-y-old women) completed a FFQ and biomarker assessments using doubly labeled water (DLW) for total energy expenditure (TEE) and 24-h urinary nitrogen. Correction methods evaluated were as follows: 1) DLW-TEE; 2) the Institute of Medicine’s (IOM’s) estimated energy requirement (EER) TEE prediction equation based on sex, height, weight, and age; 3) published NBS total energy TEE prediction (WHI-NBS-TEE) using age, BMI, race, and income; 4) reported protein versus reported energy linear regression-based residual method; and 5) a Goldberg cutoff to exclude subjects reporting energy intakes <1.35 times their basal metabolic rate. Efficacy was evaluated using correlations obtained by regressing corrected protein against biomarker protein (6.25 × urinary nitrogen/0.81). Unadjusted self-reported protein intake from the FFQ (mean = 66.7 g) correlated weakly (r = 0.31) with biomarker protein (mean = 74.9 g). DLW-TEE-corrected self-reported protein intake (mean = 90.7 g) had the strongest correlation with biomarker protein (r = 0.47). Other energy corrections yielded lower, but still significant correlations:
EER, r = 0.44 (mean = 92.1 g); WHI-NBS-TEE, r = 0.37 (mean = 90.4 g); Goldberg cutoff, r = 0.36 (mean = 88.4 g); and residual method, r = 0.35 (mean = 66.7 g). Our data indicate that proportional correction of reported protein intake using a measure of energy requirement from DLW-TEE or IOM-EER performed modestly better than other methods in this cohort. These energy adjustments, however, yielded corrected protein exceeding the biomarker protein, indicating that energy adjustment alone does not eliminate all self-reported protein reporting bias.

**Lipids**

**Dietary Intake and Biomarkers of Linoleic Acid and Mortality: Systematic Review and Meta-Analysis of Prospective Cohort Studies**


**Significance:** In prospective cohort studies, higher linoleic acid intake, assessed by dietary surveys or biomarkers, was associated with a modestly lower risk of mortality.

Current evidence on associations between intakes of linoleic acid (LA), the predominant n-6 (ω-6) fatty acid, and mortality is inconsistent and has not been summarized by a systematic review and meta-analysis. The aim was to perform a systematic review and meta-analysis of prospective cohort studies to examine associations between LA intake and mortality. We conducted a comprehensive search of MEDLINE and EMBASE databases through 31 July 2019 for prospective cohort studies reporting associations of LA (assessed by dietary surveys and/or LA concentrations in adipose tissue or blood compartments) with mortality from all causes, cardiovascular disease (CVD), and cancer. Multivariable-adjusted RRs were pooled using random-effects meta-analysis. Thirty-eight studies reporting 44 prospective cohorts were identified; these included 811,069 participants with dietary intake assessment (170,076 all-cause, 50,786 CVD, and 59,684 cancer deaths) and 65,411 participants with biomarker measurements (9758 all-cause, 6492 CVD, and 1719 cancer deaths). Pooled RRs comparing extreme categories of dietary LA intake (high vs low) were 0.87 (95% CI: 0.81, 0.94; I² = 67.9%) for total mortality, 0.87 (95% CI: 0.82, 0.92; I² = 3.7%) for CVD mortality, and 0.89 (95% CI: 0.85, 0.93; I² = 0%) for cancer mortality. Pooled RRs for each SD increment in LA concentrations in adipose tissue/blood compartments were 0.91 (95% CI: 0.87, 0.95; I² = 64.1%) for total mortality, 0.89 (95% CI: 0.85, 0.94; I² = 28.9%) for CVD mortality, and 0.91 (95% CI: 0.84, 0.98; I² = 26.3%) for cancer mortality. Meta-regressions suggested baseline age and dietary assessment methods as potential sources of heterogeneity for the association between LA and total mortality. In prospective cohort studies, higher LA intake, assessed by dietary surveys or biomarkers, was associated with a modestly lower risk of mortality from all causes, CVD, and cancer. These data support the potential long-term benefits of PUFA intake in lowering the risk of CVD and premature death.

**Carbohydrates**

**Can Dietary Viscous Fiber Affect Body Weight Independently of an Energy-Restrictive Diet? A Systematic Review and Meta-Analysis of Randomized Controlled Trials**


**Significance:** Dietary viscous fiber modestly yet significantly improved body weight and other parameters of adiposity independently of calorie restriction.

The role of dietary fiber in obesity management remains debatable. Evidence suggests that intake of viscous fiber may have the potential to facilitate weight loss. We aimed to summarize and quantify the effects of viscous fiber on body weight, BMI, waist circumference, and body fat, independent of calorie restriction, through a systematic review and meta-analysis of randomized controlled trials. Trials ≥4 wk in duration that assessed the effect of viscous fiber supplemented to an ad libitum diet along with comparator diets were included. MEDLINE, EMBASE, and the Cochrane library were searched through 24 July, 2019. Two independent reviewers extracted relevant data. Data were pooled using the generic inverse variance method and random-effects models and expressed as mean differences with 95% CIs. Interstudy heterogeneity was assessed (I² statistic). The overall certainty of evidence was explored using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach. Findings from 62 trials (n = 3877) showed that viscous fiber reduced mean body weight (-0.33 kg; 95% CI: -0.51, -0.14 kg; P = 0.004), BMI (in kg/m²) (-0.28; 95% CI: -0.42, -0.14; P = 0.0001), and waist circumference (-0.63 cm; 95% CI: -1.11, -0.16 cm; P = 0.008), with no change in body fat (-0.78%; 95% CI: -1.56%, 0.00%; P = 0.05) when consumed with an ad libitum diet. Greater reductions in body weight were observed in overweight individuals and those with diabetes and metabolic syndrome. The certainty of evidence was graded moderate for body weight, high for waist circumference and body fat, and low for BMI. Dietary viscous fiber modestly yet significantly improved body weight and other parameters of adiposity independently of calorie restriction. Future trials are warranted to address the inconsistency and imprecision identified through GRADE and to determine long-term weight-loss sustainability. This systematic review and meta-analysis was registered at clinicaltrials.gov as NCT03257449.
Effects of Whole-Grain Wheat, Rye, and Lignan Supplementation on Cardiometabolic Risk Factors in Men With Metabolic Syndrome: A Randomized Crossover Trial


Significance: The cardiometabolic effect of whole grain diets appears to differ according to enterotype.

A whole-grain (WG)-rich diet has shown to have potential for both prevention and treatment of the metabolic syndrome (MetS), which is a cluster of risk factors that increase the risk of type 2 diabetes and cardiovascular disease. Different WGs may have different health effects. WG rye, in particular, may improve glucose homeostasis and blood lipids, possibly mediated through fermentable dietary fiber and lignans. Recent studies have also suggested a crucial role of the gut microbiota in response to WG. The aim was to investigate WG rye, alone and with lignan supplements [secoisolariciresinol diglucoside (SDG)], and WG wheat diets on glucose tolerance [oral-glucose-tolerance test (OGTT)], other cardiometabolic outcomes, enterolignans, and microbiota composition. Moreover, we exploratively evaluated the role of gut microbiota enterotypes in response to intervention diets. Forty men with MetS risk profile were randomly assigned to WG diets in an 8-wk crossover study. The rye diet was supplemented with 280 mg SDG at weeks 4-8. Effects of treatment were evaluated by mixed-effects modeling, and effects on microbiota composition and the role of gut microbiota as a predictor of response to treatment were analyzed by random forest plots. The WG rye diet (± SDG supplements) did not affect the OGTT compared with WG wheat. Total and LDL cholesterol were lowered (-0.06 and -0.09 mmol/L, respectively; P < 0.05) after WG rye compared with WG wheat after 4 wk but not after 8 wk. WG rye resulted in higher abundance of *Bifidobacterium* [fold-change (FC) = 2.58, P < 0.001] compared with baseline and lower abundance of *Clostridium* genus compared with WG wheat (FC = 0.54, P = 0.02). The explorative analyses suggest that baseline enterotype is associated with total and LDL-cholesterol response to diet. WG rye, alone or with SDG supplementation, compared with WG wheat did not affect glucose metabolism but caused transient LDL-cholesterol reduction. The effect of WG diets appeared to differ according to enterotype. This trial was registered at www.clinicaltrials.gov as NCT02987595.

Low-Calorie Sweeteners

Associations of Diet Soda and Non-Caloric Artificial Sweetener Use With Markers of Glucose and Insulin Homeostasis and Incident Diabetes: The Strong Heart Family Study


Significance: Although reported consumption of diet soda and non-caloric artificial sweeteners was high, neither were associated with diabetes risk.

Non-caloric artificial sweeteners (NAS) are marketed as healthier alternatives to sugar, but the relationship between consumption of NAS and development of diabetes is unclear. This study assessed the associations of diet soda and NAS consumption with (1) early markers of insulin and glucose homeostasis (cross-sectionally) and (2) incident diabetes (over an average of 8 years of follow-up) among American Indians, a population with high rates of obesity. The study population included Strong Heart Family Study participants without cardiovascular disease or diabetes who participated in the 2007-2009 study exam (n = 1359). Diet soda and NAS consumption were assessed using a Block food frequency questionnaire and supplemental NAS questionnaire at the study exam. Fasting plasma glucose and insulin were measured during the study exam after a 12-h overnight fast. Participants were followed for incident diabetes through December 2017 using a single phone interview and medical record review; diabetes was identified by self-report and confirmed by documentation in medical records. Associations of diet soda and NAS consumption with fasting insulin, glucose, and incident diabetes were assessed using generalized estimating equations (fasting insulin and glucose analyses) and parametric survival models with Weibull distributions (incident diabetes analyses). Just under half of participants reported regularly consuming diet soda (40%) or using NAS to sweeten their beverages (41%). During an average 8 years of follow-up, we identified 98 cases of incident diabetes. After correction for multiple comparisons, there were no statistically significant associations of reported diet soda and NAS consumption with fasting insulin, fasting glucose, or incident diabetes. Although reported consumption of diet soda and NAS were high, neither were associated with diabetes risk.

Bioactives

Dose-Response Relation Between Tea Consumption and Risk of Cardiovascular Disease and All-Cause Mortality: A Systematic Review and Meta-Analysis of Population-Based Studies

Significance: Daily tea intake as part of a healthy habitual dietary pattern may be associated with lower risks of cardiovascular disease and all-cause mortality.

Tea flavonoids have been suggested to offer potential benefits to cardiovascular health. This review synthesized the evidence on the relation between tea consumption and risks of cardiovascular disease (CVD) and all-cause mortality among generally healthy adults. PubMed, EMBASE, Web of Science, Cochrane Central Register of Controlled Trials, Food Science and Technology Abstracts, and Ovid CAB Abstract databases were searched to identify English-language publications through 1 November 2019, including randomized trials, prospective cohort studies, and nested case-control (or case-cohort) studies with data on tea consumption and risk of incident cardiovascular events (cardiac or peripheral vascular events), stroke events (including mortality), CVD-specific mortality, or all-cause mortality. Data from 39 prospective cohort publications were synthesized. Linear metaregression showed that each cup (236.6 mL) increase in daily tea consumption (estimated 280 mg and 338 mg total flavonoids/d for black and green tea, respectively) was associated with an average 4% lower risk of CVD mortality, a 2% lower risk of CVD events, a 4% lower risk of stroke, and a 1.5% lower risk of all-cause mortality. Subgroup meta-analysis results showed that the magnitude of association was larger in elderly individuals for both CVD mortality (n = 4; pooled adjusted RR: 0.89; 95% CI: 0.83, 0.96; P = 0.001), with large heterogeneity (I² = 72.4%), and all-cause mortality (n = 3; pooled adjusted RR: 0.92; 95% CI: 0.90, 0.94; P < 0.0001; I² = 0.3%). Generally, studies with higher risk of bias appeared to show larger magnitudes of associations than studies with lower risk of bias. Strength of evidence was rated as low and moderate (depending on study population age group) for CVD-specific mortality outcome and was rated as low for CVD events, stroke, and all-cause mortality outcomes. Daily tea intake as part of a healthy habitual dietary pattern may be associated with lower risks of CVD and all-cause mortality among adults.

Potential Health Benefits of (Poly)Phenols Derived From Fruit and 100% Fruit Juice

Significance: Differences in (poly)phenol profiles and bioavailability likely exist between whole fruit and 100% fruit juice due to processing and fiber content.

(Poly)phenol-rich diets have been associated with reduced risk of various diseases. Coffee and tea are typically identified as dietary sources of chlorogenic acid and flavan-3-ols; however, 100% fruit juice greatly contributes to anthocyanin, flavonol, flavan-3-ols, and flavanone intake, making them complementary sources of dietary (poly)phenols. Thus, the aim of this narrative review was to provide an overview of fruit (poly)phenols and their potential health benefits. Fruit (poly)phenols have been associated with several health benefits (eg, reduced risk of cardiovascular disease and neurocognitive benefits). Although perspectives on 100% fruit juice consumption are controversial due to the perception of sugar content, growing evidence supports the role of fruit in whole and 100% juice forms to provide consumer benefits in alignment with dietary guidance. However, differences in (poly)phenol profiles and bioavailability likely exist between whole fruit and 100% fruit juice due to processing and the presence/absence of fiber. Ongoing studies are better defining similarities and differences between whole fruit and 100% fruit juice to elucidate protective mechanisms and align with processing and consumer products.

Sodium

Screening Tool for Identifying Adults With Excessive Salt Intake Among Community-Dwelling Adults: A Population-Based Cohort Study

Significance: A screening tool to identify adults with excessive salt intake was developed. By extracting groups with excessive salt intake, target populations needing intervention for salt reduction can be highlighted efficiently.

Excessive salt intake is widely known to be a cause of hypertension, cardiovascular events, and so on. However, simple tools for screening excessive salt intake are lacking. We aimed to develop a simple screening tool to identify community-dwelling adults with excessive salt intake. The present study involved participants who received health check-ups in Fukushima, Japan, in 2016 and 2017. We defined data from the 2016 check-up as the derivation set, and data from those who received check-ups in 2017 but not 2016 as the validation set. The outcome measure was excessive salt intake, defined as the estimated daily salt intake of 1 SD or more. Candidate predictors associated with the outcome were extracted using the Delphi method by an expert panel and narrowed down with clinical expertise and stepwise backward selection. The screening tool was developed using a coefficient-based multivariable scoring method and externally validated. A total of 1101 participants were included in the derivation set and 249 in the validation set. At the conclusion of the deviation process, 8 predictors were selected and scored. The areas
under the receiver operating characteristic curve for derivation and external validation were 0.70 (95% CI: 0.67, 0.74) and 0.71 (95% CI: 0.62, 0.80), respectively. The calibration slope and intercept for external validation were 1.16 and -0.03, respectively.

We developed a screening tool to identify adults with excessive salt intake. By extracting groups with excessive salt intake, target populations needing intervention for salt reduction can be highlighted efficiently.

**Gut Microbiome**

**Associations of Plasma Trimethylamine N-Oxide, Choline, Carnitine, and Betaine With Inflammatory and Cardiometabolic Risk Biomarkers and the Fecal Microbiome in the Multiethnic Cohort Adiposity Phenotype Study**


**Significance:** Plasma trimethylamine N-oxide concentrations were associated with a number of trimethylamine-producing bacterial taxa, and, along with its precursors, may contribute to inflammatory and cardiometabolic risk pathways.

Trimethylamine N-oxide (TMAO), a compound derived from diet and metabolism by the gut microbiome, has been associated with several chronic diseases, although the mechanisms of action are not well understood and few human studies have investigated microbes involved in its production. Our study aims were 1) to investigate associations of TMAO and its precursors (choline, carnitine, and betaine) with inflammatory and cardiometabolic risk biomarkers; and 2) to identify fecal microbiome profiles associated with TMAO. We conducted a cross-sectional analysis using data collected from 1653 participants (826 men and 827 women, aged 60-77 y) in the Multiethnic Cohort Study. Plasma concentrations of TMAO and its precursors were measured by LC-tandem MS. We also analyzed fasting blood for markers of inflammation, glucose and insulin, cholesterol, and triglycerides (TGs), and further measured blood pressure. Fecal microbiome composition was evaluated by sequencing the 16S ribosomal RNA gene V1-V3 region. Associations of TMAO and its precursors with disease risk biomarkers were assessed by multivariable linear regression, whereas associations between TMAO and the fecal microbiome were assessed by permutational multivariate ANOVA and hurdle regression models using the negative binomial distribution. Median (IQR) concentration of plasma TMAO was 3.05 μmol/L (2.10-4.60 μmol/L). Higher concentrations of TMAO and carnitine, and lower concentrations of betaine, were associated with greater insulin resistance (all P < 0.02). Choline was associated with higher systolic blood pressure, TGs, lipopolysaccharide-binding protein, and lower HDL cholesterol (P ranging from <0.001 to 0.03), reflecting an adverse cardiometabolic risk profile. TMAO was associated with abundance of 13 genera (false discovery rate < 0.05), including *Fusobacterium*, *Mitsuokella*, *Prevotella*, *Desulfovibrio*, and bacteria belonging to the families Ruminococcaceae and Lachnospiraceae, as well as the methanogen *Methanobrevibacter smithii*. Plasma TMAO concentrations were associated with a number of trimethylamine-producing bacterial taxa, and, along with its precursors, may contribute to inflammatory and cardiometabolic risk pathways.

**The Role of the Gut Microbiome in the Association Between Habitual Anthocyanin Intake and Visceral Abdominal Fat in Population-Level Analysis**


**Significance:** Novel data suggest that higher microbial diversity and abundance of specific taxa in the Clostridiales order may contribute to the association between higher intake of anthocyanins and lower abdominal adipose tissue.

Flavonoid intake modifies the composition of the gut microbiome, which contributes to the metabolism of flavonoids. Few studies have examined the contribution of the gut microbiome to the health benefits associated with flavonoid intake. We aimed to examine associations between habitual intakes of flavonoid subclasses and MRI-determined visceral (VAT) and subcutaneous (SAT) adipose tissue. Uniquely, we also identified associations between the aforementioned measurements and gut microbiome composition sequenced from 16S ribosomal RNA genes. We undertook cross-sectional analyses of 618 men and women (n = 368 male), aged 25-83 y, from the PopGen cohort. Higher intake of anthocyanins was associated with lower amounts of VAT [tertile (T)3-T1: -0.49 dm3; β: -8.9%; 95% CI: -16.2%, -1.1%; P = 0.03] and VAT:SAT ratio (T3-T1: -0.04; β: -9.9%; 95% CI: -17.4%, -1.6%; P = 0.02) and VAT:SAT ratio (Q4-Q1: -0.04; β: -6.5%; 95% CI: -13.3%, -0.9%; P = 0.03). Participants with the highest intakes of anthocyanin-rich foods also had higher microbial diversity (Q4-Q1: β: 0.18; 95% CI: 0.06, 0.31; P < 0.01), higher abundances of Clostridiales (Q4-Q1: β: 449; 95% CI: 96.3, 801; P = 0.04) and Ruminococcaceae (Q4-Q1: β: 313; 95% CI: 33.6, 591; P = 0.04), and lower abundance of *Clostridium* XIVa (Q4-Q1: β: -41.1; 95% CI: -72.4, -9.8; P = 0.04). Participants with the highest microbial diversity, abundances of Clostridiales and Ruminococcaceae, and lower abundance of *Clostridium* XIVa had lower amounts of VAT. Up to 18.5% of the association between intake of anthocyanin-rich foods and VAT could be explained by the gut microbiome. These novel data suggest that higher microbial diversity and abundance of specific taxa in the Clostridiales order may contribute to the association between higher intake of anthocyanins and lower abdominal adipose tissue.