ILSI North America

Nutrition Briefs

October and November 2016

Diabetes and the Metabolic Syndrome

Effect of Fructose Consumption on Insulin Sensitivity in Nondiabetic Subjects: A Systematic Review and Meta-Analysis of Diet-Intervention Trials

ter Horst KW, Schene MR, Holman R, Romijn JA, Serli MJ

American Journal of Clinical Nutrition. 2016;104(6):1562–1576

DOI: 10.3945/ajcn.116.137786

Link to full text: Click here

Significance: Short-term fructose consumption, in isocaloric exchange or in hypercaloric supplementation, promotes the development of hepatic insulin resistance in nondiabetic adults without affecting peripheral or muscle insulin sensitivity.

High fructose consumption has been suggested to contribute to several features of metabolic syndrome including insulin resistance, but no previous meta-analyses have investigated the effect of fructose on insulin sensitivity in nondiabetic subjects. A systematic review and meta-analysis of controlled diet-intervention studies in nondiabetic subjects to determine the effect of fructose on insulin sensitivity was performed. Twenty-nine articles that described 46 comparisons in 1005 normal-weight and overweight or obese participants met the eligibility criteria. An energy-matched (isocaloric) exchange of dietary carbohydrates by fructose promoted hepatic insulin resistance (SMD: 0.47; 95% CI: 0.03, 0.91; P = 0.04) but had no effect on fasting plasma insulin concentrations (MD: -0.79 pmol/L; 95% CI: -6.41, 4.84 pmol/L; P = 0.78), the homeostasis model assessment of insulin resistance (HOMA-IR) (MD: 0.13; 95% CI: -0.07, 0.34; P = 0.21), or glucose disposal rates under euglycemic hyperinsulinemic clamp conditions (SMD: 0.00; 95% CI: 20.41, 0.41; P = 1.00). Hypercaloric fructose (~25% excess of energy compared with that of the weight-maintenance control diet) raised fasting plasma insulin concentrations (MD: 3.38 pmol/L; 95% CI: 0.03, 6.73 pmol/L; P < 0.05) and induced hepatic insulin resistance (SMD: 0.77; 95% CI: 0.28, 1.26; P < 0.01) without affecting the HOMA-IR (MD: 0.18; 95% CI: -0.02, 0.39; P = 0.08) or glucose disposal rates (SMD: 0.10; 95% CI: -0.21, 0.40; P = 0.54). Larger and longer-term studies are needed to assess whether real-world fructose consumption has adverse effects on insulin sensitivity and long-term outcomes.

Sugar-Sweetened Beverage But Not Diet Soda Consumption Is Positively Associated With Progression of Insulin Resistance and Prediabetes

Ma J, Jacques PF, Meigs JB, Fox CS, Rogers GT, Smith CE, et al.

Journal of Nutrition. 2016;146(12):2544–2550

DOI: 10.3945/jn.116.234047

Link to full text: Click here

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Significance: Regular SSB intake, but not diet soda intake, is associated with a greater increase in insulin resistance and a higher risk of developing prediabetes in a group of middle-aged adults.

Previous studies have shown an inconsistent relation between habitual beverage consumption and insulin resistance and prediabetes. The objective of the present study was to test the hypothesis that the consumption of sugar-sweetened beverages (SSBs), rather than diet soda, is associated with long-term progression of insulin resistance and the development of prediabetes. This study analyzed the prospective association between cumulative mean consumption of SSBs or diet soda and incident prediabetes ($n = 1685$) identified across a median of 14 y of follow-up in participants of the Framingham Offspring cohort. This study observed that SSB intake was positively associated with incident prediabetes (P-trend < 0.001); the highest SSB consumers (>3 servings/wk; median: 6 servings/wk) had a 46% higher risk of developing prediabetes than did the SSB nonconsumers (HR: 1.46; 95% CI: 1.16, 1.83). Higher SSB intake was also associated with a greater increase in HOMA-IR (P-trend = 0.006). No prospective associations were observed between diet soda intake and risk of prediabetes (P-trend = 0.24) or changes in HOMA-IR (P-trend = 0.25). These associations were similar after additional adjustment for change in BMI.

Visceral Adiposity and Metabolic Syndrome After Very High-Fat and Low-Fat Isocaloric Diets: A Randomized Controlled Trial

Veum VL, Laupsa-Borge J, Eng Ø, Rostrup E, Larsen TH, Nordrehaug JE, et al.

American Journal of Clinical Nutrition. Published ahead of print 2016 November 30

DOI: 10.3945/ajcn.115.123463

Link to full text: Click here

Significance: These data do not support the idea that dietary fat per se promotes ectopic adiposity and cardiometabolic syndrome in humans.

Different aspects of dietary pattern, including macronutrient and food profiles, may affect visceral fat mass and metabolic syndrome. This study hypothesized that consuming energy primarily from carbohydrate or fat in diets with similar food profiles would differentially affect the ability to reverse visceral adiposity and metabolic syndrome. Forty-six men (aged 30–50 y) with body mass index (in kg/m^2) >29 and waist circumference >98 cm were randomly assigned to a very high–fat, low-carbohydrate (VHFLC; 73% of energy fat and 10% of energy carbohydrate) or low-fat, high-carbohydrate (LFHC; 30% of energy fat and 53% of energy carbohydrate) diet for 12 wk. The diets were equal in energy (8750 kJ/d), protein (17% of energy), and food profile, emphasizing low-processed, lower-glycemic foods. Mean energy intake decreased by 22% and 14% in the LFHC and VHFLC groups. The diets similarly reduced waist circumference (11–13 cm), abdominal subcutaneous fat mass (1650–1850 cm^3), visceral fat mass (1350–1650 cm^3), and total body weight (11–12 kg). The groups showed similar reductions in insulin, insulin C-peptide, glycated hemoglobin, and homeostasis model assessment of insulin resistance. Notably, improvements in circulating metabolic markers in the VHFLC group mainly were observed first after 8 wk, in contrast to more acute and gradual effects in the LFHC group. Consuming energy primarily as carbohydrate or fat for 3 mo did not differentially influence visceral fat and metabolic syndrome in a low-processed, lower-glycemic dietary context.

Bioactives

Dietary Flavonoid Intake and Incident Coronary Heart Disease: The REasons for Geographic and Racial Differences in Stroke (REGARDS) Study

Goetz ME, Judd SE, Safford MM, Hartman TJ, McClellan WM, Vaccarino V

American Journal of Clinical Nutrition. 2016;104(5):1236–1244

DOI: 10.3945/ajcn.115.129452

Link to full text: Click here

Significance: Reported anthocyanidin and proanthocyanidin intakes were inversely associated with incident CHD.

Flavonoids are dietary polyphenolic compounds with a variety of proposed beneficial cardiovascular effects, but rigorous prospective studies that examine the association between flavonoid intake and incident coronary heart disease (CHD) in geographically and racially diverse US samples are limited. With the use of the new, expanded USDA flavonoid database, this study assessed the association between total flavonoid and flavonoid subclass intakes with incident CHD in a biracial and geographically diverse cohort, as well as effect modification by age, sex, race, and region of residence. High flavonoid intake was associated with self-identified white race, exercise, not smoking, more education, and higher income. In models that adjusted for sociodemographic, health behavior, and dietary factors, there was an inverse association between anthocyanidin and proanthocyanidin intakes and incident CHD (HRs for quintile 5 compared with quintile 1—anthocyanidins: 0.71; 95% CI: 0.52, 0.98; *P*-trend = 0.04; proanthocyanidins: 0.63; 95% CI: 0.47, 0.84; *P*-trend = 0.02). There was no association between total flavonoid or other flavonoid subclass intakes and incident CHD.

The Role of Metabolism (and the Microbiome) in Defining the Clinical Efficacy of Dietary Flavonoids

Cassidy A, Minihane AM

American Journal of Clinical Nutrition. Published ahead of print 2016 November 23

DOI: 10.3945/ajcn.116.136051

Link to full text: Click here

Significance: This review identifies research areas that need to be addressed to further understand important determinants of flavonoid bioavailability and metabolism and to advance the knowledge base that is required to move toward the development of dietary guidelines and recommendations for flavonoids and flavonoid-rich foods.

At a population level, there is growing evidence of the beneficial effects of dietary flavonoids on health. However, there is extensive heterogeneity in the response to increased intake, which is likely mediated via wide interindividual variability in flavonoid absorption and metabolism. Flavonoids are extensively metabolized by phase I and phase II metabolism (which occur predominantly in the gastrointestinal tract and liver) and colonic microbial metabolism. A number of factors, including age, sex, and genotype, may affect these metabolic processes. In addition, food composition and flavonoid source are likely to affect bioavailability, and emerging data suggest a critical role for the microbiome. This review focuses on the current knowledge for the main subclasses of flavonoids, including anthocyanins, flavonols, flavan-3-ols, and flavanones, for which there

is growing evidence from prospective studies of beneficial effects on health. The identification of key factors that govern metabolism and an understanding of how the differential capacity to metabolize these bioactive compounds affect health outcomes will help establish how to optimize intakes of flavonoids for health benefits and in specific subgroups.

Sweeteners

Biological Fate of Low-Calorie Sweeteners

Magnuson BA, Carakostas MC, Moore NH, Poulos SP, Renwick AG

Nutrition Reviews. 2016;74(11):670–689

DOI: 10.1093/nutrit/nuw032

Link to full text: Click here

Significance: This review compares the similarities and differences in the chemistry, regulatory status, and biological fate of the most commonly used low= and no-calorie sweeteners.

With continued efforts to find solutions to rising rates of obesity and diabetes, there is increased interest in the potential health benefits of the use of low- and no-calorie sweeteners (LNCSs). Concerns about safety often deter the use of LNCSs as a tool in helping control caloric intake, even though the safety of LNCS use has been affirmed by regulatory agencies worldwide. In many cases, an understanding of the biological fate of the different LNSCs can help health professionals to address safety concerns. The objectives of this review are to compare the similarities and differences in the chemistry, regulatory status, and biological fate (including absorption, distribution, metabolism, and excretion) of the commonly used LNCSs: acesulfame potassium, aspartame, saccharin, stevia leaf extract (steviol glycoside), and sucralose. Understanding the biological fate of the different LNCSs is helpful in evaluating whether reports of biological effects in animal studies or in humans are indicative of possible safety concerns. Illustrations of the usefulness of this information to address questions about LNCSs include discussion of systemic exposure to LNCSs, the use of sweetener combinations, and the potential for effects of LNCSs on the gut microflora.

Estimating the Reliability of Glycemic Index Values and Potential Sources of Methodological and Biological Variability

Matthan NR, Ausman LM, Meng H, Tighiouart H, Lichtenstein AH

American Journal of Clinical Nutrition. 2016;104(4):1004–1013

DOI: 10.3945/ajcn.116.137208

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Significance: These data indicate that there is substantial variability in individual responses to GI value determinations, demonstrating that it is unlikely to be a good approach to guiding food choices.

The utility of glycemic index (GI) values for chronic disease risk management remains controversial. Although absolute GI value determinations for individual foods have been shown to vary significantly in individuals with diabetes, there is a dearth of data on the reliability of GI value determinations and potential sources of variability among healthy adults. This study examined the intra- and inter-individual variability in glycemic response to a single food challenge and methodologic and biological factors that potentially mediate this response. The

GI value for white bread was determined by using standardized methodology in 63 volunteers free from chronic disease and recruited to differ by sex, age (18-85 y), and body mass index [BMI (in kg/m^2): 20-35]. Among the biological factors assessed, insulin index and glycated hemoglobin values explained 15% and 16% of the variability in mean GI value for white bread, respectively.

Sociodemographic and Behavioral Factors Associated With Added Sugars Intake Among US Adults

Park S, Thompson FE, McGuire LC, Pan L, Galuska DA, Blanck HM

Journal of the Academy of Nutrition and Dietetics. 2016;116(10):1589–1598

DOI: 10.1016/j.jand.2016.04.012

Link to full text: Click here

Significance: Higher added sugars intake was associated with various sociodemographic and behavioral characteristics.

Reducing added sugars intake is one of the Healthy People 2020 objectives. High added sugars intake may be associated with adverse health consequences. This cross-sectional study identified sociodemographic and behavioral characteristics associated with added sugars intake among US adults (18 years and older) using the 2010 National Health Interview Survey data (n=24,967). Estimated median added sugars intake was 17.6 tsp/d for men and 11.7 tsp/d for women. For men and women, those who had significantly greater odds for being in the highest tertile of added sugars intake (men: ≥22.0 tsp/d; women: ≥14.6 tsp/d) were younger, less educated, had lower income, were less physically active, were current smokers, and were former or current infrequent/light drinkers, whereas non-Hispanic other/multiracial and those living in the West had significantly lower odds for being in the highest tertile of added sugars intake. Different patterns were found by sex. Non-Hispanic black men had lower odds for being in the highest tertile of added sugars intake, whereas non-Hispanic black women had greater odds for being in the highest tertile.

Scientific Integrity

Nutrition Research Integrity: To Believe or Not to Believe? That Is the Question!

Myers EF

Nutrition Today. 2016;51(5):251–258

DOI: 10.1097/NT.0000000000000173

Link to full text: Click here

Nutrition research integrity has become a hotly debated topic. How much confidence we can place in the results of either an individual research study or the recommendations derived from a systematic review that combines multiple studies is crucial in interpreting the research findings. Using research as the basis of public policy is dependent upon the critical appraisal and description of the amount of confidence that can be placed in the research results. In the early 2000s, this was referred to as the "quality" of the individual research study. The methodology has continued to be refined, and more recently, this has been referred to as evaluating the "risk of bias." This refinement focuses more on the aspects of the research that are likely to compromise whether we can "believe the results" and set the stage for a thoughtful dialogue about the strengths and weaknesses of nutrition research itself, versus focusing on study funding.

Publications From the ILSI North America Task Force on Partially Hydrogenated Oils (PHOs)

Trans Fatty Acids and Cholesterol Levels: An Evidence Map of the Available Science

Liska DJ, Cook CM, Wang DD, Gaine PC, Baer DJ

Food and Chemical Toxicology. 2016;98(Pt B):269–281

DOI: 10.1016/j.fct.2016.07.002

Link to full text: Click here

Mode-of-Action Evaluation for the Effect of Trans Fatty Acids on Low-Density Lipoprotein Cholesterol

Reichard JF, Haber LT

Food and Chemical Toxicology. 2016;98(Pt B):282–294

DOI: 10.1016/j.fct.2016.05.018

Link to full text: Click here

Meta-Regression Analysis of the Effect of Trans Fatty Acids on Low-Density Lipoprotein Cholesterol

Allen BC, Vincent MJ, Liska D, Haber LT

Food and Chemical Toxicology. 2016;98(Pt B):295–307

DOI: 10.1016/j.fct.2016.10.014

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The North American branch of the International Life Sciences Institute (ILSI North America) is a public, non-profit scientific foundation that advances the understanding and application of science related to the nutritional quality and safety of the food supply.

ILSI North America carries out its mission by sponsoring research programs, professional and educational programs and workshops, seminars, and publications, as well as providing a neutral forum for government, academic, and industry scientists to discuss and resolve scientific issues of common concern for the well-being of the general public. ILSI North America's programs are supported primarily by its industry membership.

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