Cardiovascular Disease

A Healthy Diet Is Associated with Less Endothelial Dysfunction and Less Low-Grade Inflammation over a 7-Year Period in Adults at Risk of Cardiovascular Disease


DOI: 10.3945/jn.114.201236
Link to full text: Click here

Significance: The dietary modification of endothelial dysfunction and low-grade inflammation, processes that are important in atherothrombosis, is possible.

This 7-year longitudinal study investigated the associations between a diet rich in fish, fruit, and vegetables, but moderate in alcohol and low in dairy products and meat and overall biomarker scores of endothelial dysfunction (ED) and low-grade inflammation in 557 participants at increased CVD risk. At baseline, participants were aged 59.6 ± 6.9 y. Measurements were performed then and after 7 y. Biomarkers were combined into overall scores (higher scores indicating worse function). Higher consumption of fish (per 100 g/wk), but not total consumption of vegetables, fruit, alcohol-containing beverages, dairy products, or meat, was associated with a lower overall ED score over 7 y (β: −0.027; 95% CI: −0.051, −0.004). Consumption of more lean fish (per 100 g/wk) and raw vegetables (per 100 g/d), and fewer high-fat dairy products (per 100 g/d) was associated with less ED [(β: −0.038; 95% CI: −0.072, −0.005), (β: −0.095; 95% CI: −0.191, 0.000), and (β: −0.070; 95% CI: −0.131, −0.009), respectively]. Consumption of more fresh fruit (per 100 g/d), wine (per 100 mL/wk), and poultry (per 100 g/d), and fewer high-fat dairy products (per 100 g/d) was associated with less low-grade inflammation [(β: −0.074; 95% CI: −0.133, −0.015), (β: −0.006; 95% CI: −0.013, 0.001), (β: −0.247; 95% CI: -0.479, -0.014), and (β: −0.100; 95% CI: −0.182, −0.019), respectively].

Multivitamin-Mineral Use Is Associated with Reduced Risk of Cardiovascular Disease Mortality among Women in the United States


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Link to full text: Click here

Significance: There is an association between multi-vitamin mineral use of >3 y and reduced CVD mortality risk for women when adjusted for covariates.

The association between multi-vitamin mineral (MVM) and multivitamin (MV) use and cardiovascular disease (CVD)-specific mortality among US adults
without CVD was examined using data from NHANES III (1988–1994; n = 8678; age ≥40 y) and mortality data from the National Death Index through 2011. No significant association was observed between CVD mortality and users of MVMs or MVs compared with nonusers; however, when users were classified by the reported length of time products were used, a significant association was found with MVM use of >3 y compared with nonusers (HR: 0.65; 95% CI: 0.49, 0.85), specifically among women (HR: 0.56; 95% CI: 0.37, 0.85) but not men (HR: 0.79; 95% CI: 0.44, 1.42). No significant association was observed for MV products and CVD mortality in fully adjusted models.

Is Complying with the Recommendations of Sodium Intake Beneficial for Health in Individuals at High Cardiovascular Risk? Findings from the PREDIMED Study

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Link to full text: Click here

Significance: Decreasing sodium intake to <2300 mg/d was associated with a reduced risk of all-cause mortality, whereas increasing the intake to >2300 mg/d was associated with a higher risk of CVD.

This observational prospective study assessed whether reductions in sodium intake to <2300 mg/d were associated with either an increased or a decreased risk of fatal and nonfatal cardiovascular disease (CVD) and all-cause mortality in 3982 participants at high CVD risk. Sodium intake was evaluated with a validated food-frequency questionnaire and categorized as low (<1500 mg/d), intermediate (≥1500 to ≤2300 mg/d), high (>2300 to ≤3400 mg/d), or very high (>3400 mg/d). Subsequently, 1-y and 3-y changes in sodium intake were calculated. Results documented 125 CVD events and 131 deaths after a 4.8-y median follow-up. Sodium intake <2300 mg/d was associated with a lower risk of all-cause mortality: 48% (HR: 0.52; 95% CI: 0.30, 0.91) and 49% (HR: 0.51; 95% CI: 0.26, 0.98) after 1 and 3 y, respectively. Increasing sodium intake after 1 y was associated with a 72% (HR: 1.72; 95% CI: 1.01, 2.91) higher risk of CVD events. The incidence rate of CVD was reduced for those who reduced their sodium intake and were randomly assigned to the Mediterranean diet interventions [4.1/10,000 (95% CI: 3.1, 8.0) compared with 4.4/10,000 (95% CI: 2.7, 12.4) person-years; P = 0.002].

Food Allergy

Administration of a Probiotic with Peanut Oral Immunotherapy: A Randomized Trial

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Link to full text: Click here

Significance: Probiotic and peanut oral immunotherapy was effective in inducing possible sustained unresponsiveness and immune changes that suggest modulation of the peanut-specific immune response.
This double-blind, placebo-controlled randomized trial evaluated a combined therapy of the probiotic Lactobacillus rhamnosus CGMCC 1.3724 and peanut oral immunotherapy (OIT) (probiotic and peanut oral immunotherapy [PPOIT]) in children (1-10 years) with peanut allergy. The primary outcome was induction of sustained unresponsiveness 2 to 5 weeks after discontinuation of treatment (referred to as possible sustained unresponsiveness). Secondary outcomes were desensitization, peanut skin prick test (SPT), and specific IgE and specific IgG4 measurements. Sixty-two children were randomized and stratified by age (≤5 and >5 years) and peanut SPT wheal size (≤10 and >10 mm); 56 reached the trial’s end. Possible sustained unresponsiveness was achieved in 82.1% receiving PPOIT and 3.6% receiving placebo (P < .001). Nine children needed to be treated for 7 to achieve sustained unresponsiveness (number needed to treat, 1.27; 95% CI, 1.06-1.59). Of the subjects, 89.7% receiving PPOIT and 7.1% receiving placebo were desensitized (P < .001). PPOIT was associated with reduced peanut SPT responses and peanut-specific IgE levels and increased peanut-specific IgG4 levels (all P < .001). PPOIT-treated participants reported a greater number of adverse events, mostly with maintenance home dosing.

Diabetes

A High-Protein Breakfast Induces Greater Insulin and Glucose-Dependent Insulinotropic Peptide Responses to a Subsequent Lunch Meal in Individuals with Type 2 Diabetes


DOI: 10.3945/jn.114.202549

Significance: In type 2 diabetic individuals, consumption of a high-protein breakfast meal attenuates the postprandial glucose response compared with a high-carbohydrate breakfast, and does not magnify the response to the second meal.

The effects of high-protein vs. high-carbohydrate breakfast meals on the metabolic and incretin responses after the breakfast and lunch meals were examined. Twelve type 2 diabetic men and women [age: 21–55 y; BMI: 30–40 kg/m²] completed two 7-d breakfast conditions consisting of 500-kcal breakfast meals as protein (35% protein/45% carbohydrate) or carbohydrate (15% protein/65% carbohydrate). On day 7, subjects completed an 8-h testing day. After an overnight fast, the subjects consumed their respective breakfast followed by a standard 500-kcal high-carbohydrate lunch meal 4 h later; blood samples were taken throughout the day. Postbreakfast glucose and glucose-dependent insulinoorphic peptide (GIP) area under the curves (AUCs) were lower after the protein vs. carbohydrate condition (17% vs. 23%, respectively) (P < 0.05), whereas postbreakfast insulin, C-peptide, glucagon, and glucagon-like peptide 1 (GLP-1) AUCs were not different between conditions. A protein-rich breakfast may reduce the consequences of hyperglycemia in this population. Postlunch insulin, C-peptide, and GIP AUCs were greater after the protein vs. carbohydrate condition (all, P < 0.05), but postlunch AUCs were not different between conditions. The overall glucose, glucagon, and GLP-1 responses (e.g., 8 h) were greater after the protein vs. carbohydrate condition (all, P < 0.05).
Sugar-Sweetened Product Consumption Alters Glucose Homeostasis Compared with Dairy Product Consumption in Men and Women at Risk of Type 2 Diabetes Mellitus

DOI: 10.3945/jn.114.204503

Significance: Sugar-sweetened product consumption is associated with less favorable values for homeostasis model assessment 2–insulin sensitivity, liquid meal tolerance test disposition index, HDL-cholesterol, and serum 25(OH)D in men and women at risk of type 2 diabetes vs. baseline values and values during dairy product consumption.

This randomized, 2-period crossover trial compared the effects of dairy and sugar-sweetened product (SSP) consumption on insulin sensitivity and pancreatic β-cell function in men and women at risk of the development of type 2 diabetes mellitus (T2DM) who habitually consume sugar-sweetened beverages. Participants consumed dairy products (474 mL/d 2% milk and 170 g/d low-fat yogurt) and SSPs (710 mL/d nondiet soda and 108 g/d nondairy pudding), each for 6 wk, with a 2-wk washout between treatments. A liquid meal tolerance test (LMTT) was administered at baseline and the end of each period. Changes from baseline were significantly different between dairy product and SSP conditions for median homeostasis model assessment 2–insulin sensitivity (HOMA2–%S) (1.3 vs. −21.3%, respectively, \(P = 0.009\); baseline = 118%), mean LMTT disposition index (−0.03 vs. −0.36, respectively, \(P = 0.011\); baseline = 2.59), mean HDL-cholesterol (0.8 vs. −4.2%, respectively, \(P = 0.015\); baseline = 44.3 mg/dL), and mean serum 25-hydroxyvitamin D [25(OH)D] (11.7 vs. −3.3, respectively, \(P = 0.022\); baseline = 24.5 μg/L).

Association Between Familial Hypercholesterolemia and Prevalence of Type 2 Diabetes Mellitus

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Significance: The prevalence of type 2 diabetes among patients with familial hypercholesterolemia was significantly lower than among unaffected relatives, with variability by mutation type.

The association between type 2 diabetes (T2DM) prevalence and familial hypercholesterolemia was assessed in this cross-sectional study in 63,320 individuals who underwent DNA testing for familial hypercholesterolemia. Deleteriousness and nondeleteriousness of familial hypercholesterolemia mutations were based on literature or laboratory function testing. Low-density lipoprotein (LDL) receptor mutations were considered more severe than apolipoprotein B gene (APOB) mutations, and receptor-negative LDL receptor mutations were considered more severe than receptor-deficient mutations. The prevalence of T2DM was 1.75% in familial hypercholesterolemia patients (n = 440/25,137) vs 2.93% in unaffected relatives (n = 1119/38,183) (\(P < .001\); OR, 0.62 [95% CI, 0.55–0.69]). The adjusted prevalence of T2DM in familial hypercholesterolemia, determined using multivariable regression models, was 1.44% (difference, 1.49% [95% CI, 1.24%-1.71%]) (OR, 0.49 [95% CI, 0.41-0.58]). The adjusted prevalence of
T2DM by APOB vs LDL receptor gene was 1.91% vs 1.33% (OR, 0.65 [95% CI, 0.48-0.87] vs OR, 0.45 [95% CI, 0.38-0.54]), and the prevalence for receptor-deficient vs receptor-negative mutation carriers was 1.44% vs 1.12% (OR, 0.49 [95% CI, 0.40-0.60] vs OR, 0.38 [95% CI, 0.29-0.49]), respectively (P for trend <.001 in both comparisons).

**Metabolic Syndrome**

**Greater Healthful Food Variety as Measured by the US Healthy Food Diversity Index Is Associated with Lower Odds of Metabolic Syndrome and its Components in US Adults**


DOI: 10.3945/jn.114.199125

Link to full text: Click here

**Significance:** Greater healthful food variety was associated with lower odds of metabolic syndrome (MetS) and some MetS components in the total population, non-Hispanic white and non-Hispanic Black adults.

The US Healthy Food Diversity (HFD) index was used simultaneously to measure dietary variety, quality, and proportionality, hypothesizing a priori that race/ethnicity may moderate associations between diet and health. A representative sample of 7470 adults with two 24-h recalls and complete outcome data from NHANES 2003–2006 were selected. US HFD values were generated using a previously validated equation with a theoretical range from 0 to nearly 1, with higher scores indicative of more varied diets with a higher proportion of healthful food groups. Adults in the third vs. first US HFD tertile had 21% lower odds of metabolic syndrome (MetS) [OR (95% CI): 0.79 (0.64, 0.98)] as well as lower odds of hypertension [0.83 (0.70, 0.995) and elevated waist circumference [0.75 (0.66, 0.86] after multivariable adjustment (P-trend < 0.05). The age- and sex-adjusted odds of low serum HDL-cholesterol and impaired fasting plasma glucose (P-trend < 0.05) were lower in the highest vs. lowest US HFD tertile but attenuated with multivariable adjustment (P = 0.06 and 0.22, respectively). Notably, the US HFD index was only protective against adiposity among non-Hispanic white (NHW) and non-Hispanic black adults, and MetS associations were driven by NHW adults.

**A Calorie-Restriction Diet Supplemented with Fish Oil and High-Protein Powder is Associated with Reduced Severity of Metabolic Syndrome in Obese Women**


DOI: 10.1038/ejcn.2014.196

Link to full text: Click here

**Significance:** A calorie-restriction (CR) dietary intervention combined with various macronutrients can reduce the severity of metabolic syndrome (MetS) in women and increase recovery from MetS by almost twofold in comparison with a CR alone.

The effects of a calorie-restriction diet (CR) supplemented with protein and n-3 polyunsaturated fatty acids (PUFAs) in 143 women with metabolic syndrome (MetS) were evaluated. Subjects were assigned to four dietary interventions:
1500-kcal CR, calorie-restriction meal-replacement diet (CRMR), calorie-restriction diet with fish oil supplementation (CRF) and calorie-restriction meal-replacement diet with fish oil supplementation (CRMRF). The changes in anthropometric measures, metabolic profiles, inflammatory response and the Z-score of severity of MetS were evaluated. Results showed that 136 patients completed the 12-week study. Reductions in body weight (BW), BMI and waist circumference (WC) were observed in all groups. BMI and triglyceride (TG) levels decreased significantly in the CRMR, CRF and CRMRF groups, but not in the CR group. The homeostasis model assessment of insulin resistance (HOMA-IR) had significantly improved in all four groups, and the levels of interleukin-6 (IL-6) and C-reactive protein (CRP) had significantly decreased in the CRF and CRMRF groups. Following the interventions, the changes in WC, mean arterial pressure (MAP), fasting blood glucose (FBG), TGs, HOMA-IR, CRP and IL-6 significantly correlated with the reductions in Z-score of MetS severity.

**Sugar-Sweetened Beverages**

**Sugar-Containing Beverage Intake in Toddlers and Body Composition Up to Age 6 Years: The Generation R Study**


DOI: 10.1038/ejcn.2015.2

Link to full text: Click here

**Significance:** Higher sugar-containing beverages intake at 13 months was associated with higher BMI up to age 6 years in girls but not in boys.

The association of sugar-containing beverages (SCBs) intake at 13 months with BMI development until 6 years and body composition at age 6 years was examined in 2371 Dutch children from a population-based prospective cohort study. Results showed that in girls, higher SCB intake at 13 months was significantly associated with higher BMI at ages 2, 3, 4 and 6 years (at age 6 years BMI (s.d. score) increase 0.11 (95% CI: +0.00; 0.23), high versus low intake). We observed a tendency towards higher android/gynoid fat ratio in girls with high intake (s.d. increase 0.14 (95% CI −0.02; 0.29), versus low intake) but not with body fat percentage. In boys, there was no association with BMI or body composition, but boys with high SCB intake at 13 months were taller at age 6 years (s.d. increase 0.14 (95% CI +0.00; 0.27), versus low intake).

**A Metabolomics Approach to the Identification of Biomarkers of Sugar-Sweetened Beverage Intake**


DOI: 10.3945/ajcn.114.095604

Link to full text: Click here

**Significance:** The present metabolomics-based strategy proved to be successful in the identification of sugar-sweetened beverage biomarkers.

This study used a metabolomics approach to identify a panel of urinary biomarkers indicative of sugar-sweetened beverage (SSB) consumption from a national food consumption survey and subsequently validated this panel in an acute
intervention study. Heat map analysis was performed to identify correlations between 1H nuclear magnetic resonance (NMR) spectral regions and SSB intakes in 565 participants of the National Adult Nutrition Survey. Metabolites were identified and receiver operating characteristic (ROC) analysis was performed to assess sensitivity and specificity of biomarkers. The panel of biomarkers was validated in an acute study (n = 10). A fasting first-void urine sample and post-prandial samples (2, 4, 6 h) were collected after SSB consumption. A panel of 4 biomarkers—formate, citrulline, taurine, and isocitrate—was identified as markers of SSB intake. This panel had an area under the curve of 0.8 for ROC analysis and a sensitivity and specificity of 0.7 and 0.8, respectively. All 4 biomarkers were identified in the SSB sample. After acute consumption of an SSB drink, all 4 metabolites increased in the urine.

**Protein**

**Higher-Protein Diets Are Associated with Higher HDL Cholesterol and Lower BMI and Waist Circumference in US Adults**

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DOI: 10.3945/jn.14.205203

Link to full text: [Click here](#)

**Significance:** Americans who consume dietary protein between 1.0 and 1.5 g/kg BW potentially have a lower risk of developing cardiometabolic disease.

This study examined usual protein intake [g/kg body weight (BW)] patterns stratified by weight status and their associations with cardiometabolic risk using data from the NHANES, 2001–2010 (n = 23,876 adults ≥19 y of age). Linear and decile trends for association of usual protein intake with cardiometabolic risk factors including blood pressure, glucose, insulin, cholesterol, and triglycerides were determined after controlling for covariates. Results showed that usual protein intake varied across deciles from 0.69 ± 0.004 to 1.51 ± 0.009 g/kg BW (means ± SEs). Usual protein intake was inversely associated with BMI (−0.47 kg/m² per decile and −4.54 kg/m² per g/kg BW) and waist circumference (−0.53 cm per decile and −2.45 cm per g/kg BW), whereas a positive association was observed between protein intake and HDL-cholesterol (0.01 mmol/L per decile and 0.14 mmol/L per g/kg BW, P < 0.00125).

**Hypertension**

**Daily Blueberry Consumption Improves Blood Pressure and Arterial Stiffness in Postmenopausal Women with Pre- and Stage 1-Hypertension: A Randomized, Double-Blind, Placebo-Controlled Clinical Trial**


DOI: 10.1016/j.jand.2014.11.001

Link to full text: [Click here](#)

**Significance:** Daily blueberry consumption may reduce blood pressure and arterial stiffness, which may be due, in part, to increased nitric oxide production.
The effects of daily blueberry consumption for 8 weeks on blood pressure and arterial stiffness in 48 postmenopausal women with pre- and stage 1-hypertension were examined in an 8-week, randomized, double-blind, placebo-controlled clinical trial. Participants were randomly assigned to receive either 22 g freeze-dried blueberry powder or 22 g control powder. Resting brachial systolic and diastolic blood pressures were evaluated and arterial stiffness was assessed using carotid-femoral pulse wave velocity and brachial-ankle pulse wave velocity. C-reactive protein, nitric oxide, and superoxide dismutase were measured at baseline, 4 weeks, and 8 weeks. After 8 weeks, systolic blood pressure and diastolic blood pressure (131±17 mm Hg [P<0.05] and 75±9 mm Hg [P<0.01], respectively) and brachial-ankle pulse wave velocity (1,401±122 cm/second; P<0.01) were significantly lower than baseline levels (138±14 mm Hg, 80±7 mm Hg, and 1,498±179 cm/second, respectively), with significant (P<0.05) group×time interactions in the blueberry powder group, whereas there were no changes in the group receiving the control powder. Nitric oxide levels were greater (15.35±11.16 μmol/L; P<0.01) in the blueberry powder group at 8 weeks compared with baseline values (9.11±7.95 μmol/L), whereas there were no changes in the control group.

**Dietary Phytochemical Index is Inversely Associated With the Occurrence of Hypertension in Adults: A 3-Year Follow-Up (The Tehran Lipid and Glucose Study)**

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DOI: 10.1038/ejcn.2014.233

Link to full text: Click here

**Significance:** Consumption of phytochemical-rich foods may prevent the development of hypertension.

This prospective study aimed to determine the association of dietary phytochemical index (PI) with the occurrence of hypertension (HTN) after 3 years of follow-up in 1546 non-hypertensive subjects, aged 20–70 years. Dietary PI was calculated as (dietary energy derived from phytochemical-rich foods (kcal)/total daily energy intake (kcal)) × 100. Blood pressure was measured at baseline and after 3 years of follow-up. The odds of HTN after 3 years in each quartile category of dietary PI were estimated by logistic regression model and adjusted for potential variables. The mean age of participants was 38.0±12.0 years and 43% were male. The mean dietary PI was 29.1±11.8. After 3 years of follow-up, 265 (17.1%) new cases of HTN were identified. No significant changes were observed in the systolic and diastolic blood pressure across quartile categories of dietary PI. After adjustment for confounders, the odds (95% CI) of HTN across quartiles of dietary PI were 1.00, 0.97 (0.62–1.38), 0.69 (0.45–1.07) and 0.52 (0.32–0.84) (P for trend=0.004).

**Probiotics**

*The Effect of a Multi-Strain Probiotic on the Resistance Toward Escherichia Coli Challenge in a Randomized, Placebo-Controlled, Double-Blind Intervention Study*


DOI: 10.1038/ejcn.2014.238
A parallel, double-blind, placebo-controlled 4-week intervention was performed in healthy males, to study the effect of a blend of probiotic bacteria (Lactobacillus helveticus Rosell-52, Lactobacillus rhamnosus Rosell-11, Bifidobacterium longum ssp. longum Rosell-175) and a probiotic yeast (Saccharomyces cerevisiae var boulardii CNCM I-1079) on enterotoxigenic Escherichia coli (ETEC) challenge. Primary outcomes studied were fecal ETEC excretion and total fecal output per day. Subjects were randomized to the probiotic (5 × 10⁹ colony-forming units (CFUs); twice daily; n=30) or placebo group (twice daily; n=30). After 2 weeks, subjects were orally challenged with a live attenuated ETEC (3 × 10⁹ CFU), previously demonstrated to induce mild, short-lived symptoms of a foodborne infection. The ETEC challenge induced a significant increase in fecal ETEC excretion in both groups. However, a statistically significant increase in fecal output was only observed in the probiotic group. ETEC challenge resulted in a decrease in the percentage of fecal dry weight, and an increase in reported Bristol Stool Score, stool frequency and GI complaints. Dietary probiotics significantly decreased the percentage of fecal dry weight. In addition, ETEC increased C-reactive protein, total secretory Immunoglobulin A (IgA) and Immunoglobulin G Colonization Factor Antigen II.

Flavonoids

Chronic Consumption of Flavanone-Rich Orange Juice Is Associated with Cognitive Benefits: An 8-Wk, Randomized, Double-Blind, Placebo-Controlled Trial in Healthy Older Adults

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This study investigated whether 8 wk of daily flavanone-rich orange juice consumption was beneficial for cognitive function in healthy older adults. High-flavanone (305 mg) 100% orange juice and an equicaloric low-flavanone (37 mg) orange-flavored cordial (500 mL) were consumed daily for 8 wk by 37 healthy older adults (mean age: 67 y) according to a crossover, double-blind, randomized design separated by a 4-wk washout. Cognitive function, mood, and blood pressure were assessed at baseline and follow-up by using standardized validated tests. Results showed that global cognitive function was significantly better after 8-wk consumption of flavanone-rich juice than after 8-wk consumption of the low-flavanone control. No significant effects on mood or blood pressure were observed.

Cocoa Flavanol Consumption Improves Cognitive Function, Blood Pressure Control, and Metabolic Profile in Elderly Subjects: The Cocoa, Cognition, and Aging (Cocoa) Study—A Randomized Controlled Trial

Significance: Regular consumption of cocoa flavanols can reduce some measures of age-related cognitive dysfunction, possibly through an improvement in insulin sensitivity.

This double-blind, controlled, parallel-arm study evaluated the effect of flavanol consumption on cognitive performance in 90 cognitively intact elderly subjects without clinical evidence of cognitive dysfunction. Subjects were randomly assigned to consume daily for 8 wk a drink containing 993 mg [high flavanol (HF)], 520 mg [intermediate flavanol (IF)], or 48 mg [low flavanol (LF)] cocoa flavanols (CFs). Cognitive function was assessed at baseline and after 8 wk by using the Mini-Mental State Examination (MMSE), the Trail Making Test (TMT) A and B, and the Verbal Fluency Test (VFT). The changes in MMSE score in the 3 different treatments were not different. In contrast, there was a positive impact of the intervention on specific aspects of cognitive function. Mean changes (±SEs) in the time required to complete the TMT A and B after consumption of the HF (−8.6 ± 0.4 and −16.5 ± 0.8 s, respectively) and IF (−6.7 ± 0.5 and −14.2 ± 0.5 s, respectively) drinks significantly (P < 0.0001) differed from that after consumption of the LF drinks (−0.8 ± 1.6 and −1.1 ± 0.7 s, respectively). Similarly, VFT scores significantly improved among all treatment groups, but the magnitude of improvement in the VFT score was significantly (P < 0.0001) greater in the HF group (7.7 ± 1.1 words/60 s) than in the IF (3.6 ± 1.2 words/60 s) and LF (1.3 ± 0.5 words/60 s) groups. Significantly different improvements in insulin resistance, blood pressure, and lipid peroxidation were also observed for the HF and IF groups in comparison with the LF group. Changes in insulin resistance explained ~17% of changes in composite z score (partial r² = 0.1703, P < 0.0001).