Exclusive Webinar Presentation

The Latest Science on the Many Health Benefits of Tree Nuts: Type 2 Diabetes, Cardiovascular Disease and Weight Management

Presented by: Penny Kris-Etherton, PhD, RD, FAHA, Richard D. Mattes, MPH, PhD, RD, and Sharon Palmer, RDN

Learning Library
TODAY'S DIETITIAN

Complimentary 1-Credit Continuing Education Webinar
Nuts and Clinical Trials, Mechanisms and Recommendations

Penny Kris-Etherton, PhD, RD, FAHA

- **Affiliations:** Pennsylvania State University, AHA Nutrition Committee
- **Disclosure:** Dr. Kris-Etherton has no disclosures for this program.
Outline

1. Epidemiologic and clinical trial evidence in support of current dietary recommendations for nuts
2. Mechanisms that account for the cardiometabolic benefits of nuts
3. Dietary recommendations for nuts
4. Summary
### WHO - The Global Burden of Disease Study

#### The World's Top 12 Health Problems

**Ranked by Disability-Adjusted Life Years (DALYs)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>1990</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower respiratory infection</td>
<td>Ischemic heart disease</td>
</tr>
<tr>
<td>2</td>
<td>Diarrhea</td>
<td>Lower respiratory infection</td>
</tr>
<tr>
<td>3</td>
<td>Preterm birth</td>
<td>Stroke</td>
</tr>
<tr>
<td>4</td>
<td>Ischemic heart disease</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>5</td>
<td>Stroke</td>
<td>HIV</td>
</tr>
<tr>
<td>6</td>
<td>COPD</td>
<td>Low back pain</td>
</tr>
<tr>
<td>7</td>
<td>Malaria</td>
<td>Malaria</td>
</tr>
<tr>
<td>8</td>
<td>Tuberculosis</td>
<td>COPD</td>
</tr>
<tr>
<td>9</td>
<td>Protein, energy malnutrition</td>
<td>Preterm birth</td>
</tr>
<tr>
<td>10</td>
<td>Neonatal encephalitis</td>
<td>Road injury</td>
</tr>
<tr>
<td>11</td>
<td>Low back pain</td>
<td>Major depressive disorders</td>
</tr>
<tr>
<td>12</td>
<td>Road injury</td>
<td>Neonatal encephalitis</td>
</tr>
</tbody>
</table>

- Pink: Communicable, neonatal/maternal disease
- Green: Noncommunicable disease
- Blue: Injury

**The TOP 12 RISK FACTORS**
Factors Causing the Greatest "Loss of Health"

<table>
<thead>
<tr>
<th>Rank</th>
<th>1990</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low body weight</td>
<td>High blood pressure</td>
</tr>
<tr>
<td>2</td>
<td>Household air pollution</td>
<td>Smoking</td>
</tr>
<tr>
<td>3</td>
<td>Smoking</td>
<td>Alcohol</td>
</tr>
<tr>
<td>4</td>
<td>High blood pressure</td>
<td>Household air pollution</td>
</tr>
<tr>
<td>5</td>
<td>Lack of breastfeeding</td>
<td>Low fruit consumption</td>
</tr>
<tr>
<td>6</td>
<td>Alcohol</td>
<td>High body mass index</td>
</tr>
<tr>
<td>7</td>
<td>Ambient particulate matter</td>
<td>High fasting plasma glucose</td>
</tr>
<tr>
<td>8</td>
<td>Low fruit consumption</td>
<td>Low body weight</td>
</tr>
<tr>
<td>9</td>
<td>High fasting plasma glucose</td>
<td>Ambient particulate matter</td>
</tr>
<tr>
<td>10</td>
<td>High body mass index</td>
<td>Inactivity</td>
</tr>
<tr>
<td>11</td>
<td>Low iron intake</td>
<td>High salt intake</td>
</tr>
<tr>
<td>12</td>
<td>High salt intake</td>
<td>Low nut/seed consumption</td>
</tr>
</tbody>
</table>

**Rank and role.** GBD 2010 documents major shifts in DALYs and risk factors since 1990, but some doubt the new data.

Healthy Dietary Patterns

• 2015 DGAC identified a healthy dietary pattern as:
  • High in vegetables, fruits, whole grains, low-fat dairy, seafood, legumes, and nuts
  • Moderate in alcohol
  • Lower in red and processed meats
  • Low in added sugars (not more than 10% of total energy)
  • Low in refined grains

• The DGAC also recommends that, as part of a healthy dietary pattern:
  • Saturated fat not exceed 10% of total energy (emphasizing substitution of polyunsaturated fats for saturated fats)
  • Limiting sodium intake to not more than 2300 mg per day
  • Calories to meet energy needs and to achieve and maintain ideal body weight

• Associated with more favorable environmental outcomes.

(2015 DGAC: Meeting 7)
Actions for Individuals and Families/Households

• Improve food & menu choices, modify recipes, and watch portion sizes.

• Include more vegetables, fruits, whole grains, seafood, nuts, legumes, low/non-fat dairy.

• Reduce red and processed meat, refined grains, added sugars, sodium, and saturated fat. Substitute SFA with PUFA and replace solid animal fat with vegetable oils and nuts.

Chapter 4: Foods and Nutrients to Increase

Key Recommendations

Individuals should meet the following recommendations as part of a healthy eating pattern and while staying within their calorie needs.

Increase vegetable and fruit intake.

Eat a variety of vegetables, especially dark-green and red and orange vegetables and beans and peas.

Consume at least half of all grains as whole grains. Increase whole-grain intake by replacing refined grains with whole grains.

Increase intake of fat-free or low-fat milk and milk products, such as milk, yogurt, cheese, or fortified soy beverages.\(^5^8\)

Choose a variety of protein foods, which include seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds.

Increase the amount and variety of seafood consumed by choosing seafood in place of some meat and poultry.

Replace protein foods that are higher in solid fats with choices that are lower in solid fats and calories and/or are sources of oils.

Use oils to replace solid fats where possible.

Choose foods that provide more potassium, dietary fiber, calcium, and vitamin D, which are nutrients of concern in American diets. These foods include vegetables, fruits, whole grains, and milk and milk products.

(USDA, *Dietary Guidelines for Americans*, 2010)
CVD Benefits of Nut & Peanut Consumption
Frequency of Nut Consumption Reduces CHD Risk in a Dose-Response Manner

Results are from four epidemiologic studies

Walnut Consumption is Associated with Lower Risk of Type 2 Diabetes in Women

Frequency of Walnut Consumption

<table>
<thead>
<tr>
<th></th>
<th>Never/Rarely</th>
<th>&lt; 1 Sv/Wk</th>
<th>1 Sv/Wk</th>
<th>≥ 2 Sv/Wk</th>
<th>P-Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivariate Model + BMI</td>
<td>1.00</td>
<td>0.96 (0.90-1.02)</td>
<td>0.87 (0.75-1.01)</td>
<td>0.76 (0.62-0.94)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

(Pan et al, *J Nutr*, 2013)
<table>
<thead>
<tr>
<th>Total Mortality, Quintile</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nut Intake Only (SCCS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1767</td>
<td>1 [Reference]</td>
<td>791</td>
<td>1 [Reference]</td>
<td>976</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>2</td>
<td>1543</td>
<td>0.92 (0.85-0.99)</td>
<td>955</td>
<td>0.88 (0.80-0.98)</td>
<td>588</td>
<td>0.83 (0.74-0.93)</td>
</tr>
<tr>
<td>3</td>
<td>801</td>
<td>0.81 (0.74-0.88)</td>
<td>352</td>
<td>0.76 (0.66-0.87)</td>
<td>449</td>
<td>0.84 (0.75-0.95)</td>
</tr>
<tr>
<td>4</td>
<td>1190</td>
<td>0.78 (0.72-0.84)</td>
<td>716</td>
<td>0.72 (0.64-0.81)</td>
<td>474</td>
<td>0.77 (0.68-0.87)</td>
</tr>
<tr>
<td>5</td>
<td>955</td>
<td>0.73 (0.67-0.79)</td>
<td>518</td>
<td>0.70 (0.62-0.79)</td>
<td>437</td>
<td>0.75 (0.66-0.85)</td>
</tr>
<tr>
<td>P value for trend</td>
<td>&lt;.001</td>
<td></td>
<td>&lt;.001</td>
<td></td>
<td>.007</td>
<td></td>
</tr>
</tbody>
</table>

Peanut Intake (SMHS/SWHS)

<table>
<thead>
<tr>
<th>Total Mortality, Quintile</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
<th>Total No. of Deaths</th>
<th>Adjusted HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2328</td>
<td>1 [Reference]</td>
<td>1035</td>
<td>1 [Reference]</td>
<td>1293</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>2</td>
<td>1121</td>
<td>0.81 (0.76-0.88)</td>
<td>282</td>
<td>0.87 (0.76-1.00)</td>
<td>839</td>
<td>0.80 (0.73-0.87)</td>
</tr>
<tr>
<td>3</td>
<td>1393</td>
<td>0.78 (0.73-0.84)</td>
<td>467</td>
<td>0.77 (0.69-0.87)</td>
<td>926</td>
<td>0.79 (0.72-0.86)</td>
</tr>
<tr>
<td>4</td>
<td>1786</td>
<td>0.81 (0.76-0.86)</td>
<td>816</td>
<td>0.82 (0.75-0.91)</td>
<td>970</td>
<td>0.80 (0.73-0.87)</td>
</tr>
<tr>
<td>5</td>
<td>1516</td>
<td>0.83 (0.77-0.88)</td>
<td>787</td>
<td>0.83 (0.75-0.91)</td>
<td>729</td>
<td>0.83 (0.75-0.91)</td>
</tr>
<tr>
<td>P value for trend</td>
<td>&lt;.001</td>
<td></td>
<td>&lt;.001</td>
<td></td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

Primary Prevention of Cardiovascular Disease with a Mediterranean Diet

Ramón Estruch, M.D., Ph.D., Emilio Ros, M.D., Ph.D., Jordi Salas-Salvadó, M.D., Ph.D., Maria-Isabel Covas, D.Pharm., Ph.D., Dolores Corella, D.Pharm., Ph.D., Fernando Arós, M.D., Ph.D., Enrique Gómez-Gracia, M.D., Ph.D., Valentina Ruiz-Gutiérrez, Ph.D., Miquel Fiol, M.D., Ph.D., José Lapetra, M.D., Ph.D., Rosa Maria Lamuela-Raventós, D.Pharm., Ph.D., Lluís Serra-Majem, M.D., Ph.D., Xavier Pintó, M.D., Ph.D., Josep Basora, M.D., Ph.D., Miguel Angel Muñoz, M.D., Ph.D., José V. Sorlí, M.D., Ph.D., José Alfredo Martínez, D.Pharm, M.D., Ph.D., and Miguel Angel Martínez-González, M.D., Ph.D., for the PREDIMED Study Investigators*
PREDIMED Trial: Design

- Men: 55-80 yr
- Women: 60-80 yr
- High CV risk without CVD
  - Type 2 diabetics
  - 3+ risk factors

Random

1. Smoking
2. Hypertension
3. ↑ LDL
4. ↓ HDL
5. Overweight/obese
6. Family history

All free of CVD at baseline

**MedDiet + Olive Oil**
N=2500

**MedDiet + Nuts**
N=2500

**CONTROL GROUP**
N=2500

Primary Prevention of Cardiovascular Disease with a Mediterranean Diet: The PREDIMED Trial

- Participants (n = 7447) were randomly assigned to:
  - Mediterranean diet supplemented with extra-virgin olive oil (1 L/week)
  - Mediterranean diet supplemented with mixed nuts (30 g/d; 15 g walnuts; 7.5 g almonds; 7.5 g hazelnuts)
  - Control diet (advice to reduce dietary fat)

- Participants received quarterly individual and group education sessions and free extra-virgin olive oil or mixed nuts.

- The primary end point was the rate of major cardiovascular events (myocardial infarction, stroke, or death from cardiovascular causes). The trial was stopped after a median follow-up of 4.8 years rather than continuing for 6 years, as planned.

### Intake of Energy and Nutrients at the End of the Trial by Study Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>MedDiet + EVOO</th>
<th>MedDiet + Nuts</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, kcal</td>
<td>2172</td>
<td>2229</td>
<td>1960</td>
</tr>
<tr>
<td>CHO, % E</td>
<td>40</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>Fat, % E</td>
<td>41</td>
<td>42</td>
<td>37</td>
</tr>
<tr>
<td>SFA, % E</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>MUFA, % E</td>
<td>22</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>PUFA, % E</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Linoleic acid, g/d</td>
<td>12</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>ALA, g/d</td>
<td>1.3</td>
<td>1.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Marine n-3 FA, g/d</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

PREDIMED Trial:
The Incidence of Acute Myocardial Infarction, Stroke, and Death from Cardiovascular Causes by Treatment

Kaplan-Meier Estimates of Incidence of the Significant Separate Component (Stroke) of the Primary Endpoint

Figure S6.

Recent Evidence from PREDIMED: Further Benefits of Olive Oil and Nuts

• Both Med diet groups
  • Decreased diastolic BP versus the control. (Toledo et al, BMC Med, 2013)
  • Improved cognition measured by MMSE and CDT scores. (Martinez-Lapiscina et al, J Neurol Neurosurg Psychiatry, 2013)
  • Decreased systolic & diastolic blood pressure, total cholesterol and LDL-C, fasting blood glucose, and inflammatory biomarkers. (Domenech et al, Hypertension, 2014)
Cumulative Incidence of Diabetes During 5.5 Years

(Salas-Salvado et al, *Diabetes Care*, 2011)
Recent Evidence from PREDIMED: Further Benefits of Olive Oil and Nuts

• Benefits of nuts
  • Increased nut consumption reduced risk of mortality (HR 0.37; 95% CI 0.22 to 0.66). (Gausch-Ferré et al, *BMC Med*, 2014)
  • Decreased progression of internal carotid intima-media thickness and plaque. (Sala-Vila et al, *Arterioscler Thromb Vasc Biol*, 2014)

• Benefits of extravirgin olive oil
  • Decreased risk of atrial fibrillation versus the control group. Nuts had no effect. (Martinez-González et al, *Circulation*, 2014)
Effect of Nut-Enriched Diets on Serum Lipids and Lipoproteins by Level of Nut Intake

A Pooled Analysis of 25 Feeding Trials (1284 Data Points)

(Sabaté J et al, Arch Intern Med, 2010)
Effects of Daily Almond Consumption on Cardiometabolic Risk Factors in Individuals with Elevated LDL-Cholesterol:
Lipids and lipoproteins and body composition

(Berryman et al, J Am Heart Assoc, 2015)
**Experimental Design**

**Screening Visit**

**Measures:**
- Ht/wt
- Blood pressure
- Blood draw (CBC, Chem 24)

**Qualifications:**
- Male/ Female
- Age: 30-65
- BMI: 20-35
- LDL-C: 50th-95th percentile
- Non-smokers
- Not taking cholesterol-lowering medications/ supplements

**Clinic Visit:** Blood draw, blood pressure, DXA, waist circumference

**Experimental Design**

- **Weeks 1-6**
  - Step I diet with 1.5 oz almonds

- **Weeks 9-14**
  - Step I diet with 1.5 oz almonds

- **Diet period 2 endpoint visit**

**Randomization**

- 2 wk break
- 2 wk break
## Diet Design: Sample Menu

Step 1 diet + almonds OR Step 1 diet without almonds (control)

<table>
<thead>
<tr>
<th>Breakfast:</th>
<th>Snack:</th>
<th>Lunch:</th>
<th>Dinner:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% milk</td>
<td>1.5 oz. almonds</td>
<td>White bread</td>
<td>Chicken parmesan</td>
</tr>
<tr>
<td>Oatmeal</td>
<td>OR</td>
<td>Deli turkey</td>
<td>Broccoli</td>
</tr>
<tr>
<td>Apple juice</td>
<td>106 g banana muffin</td>
<td>Provolone cheese</td>
<td>Dinner roll</td>
</tr>
<tr>
<td>English muffin</td>
<td>VS</td>
<td>Mayonnaise</td>
<td>Margarine</td>
</tr>
<tr>
<td>Blueberries</td>
<td></td>
<td>Pretzels</td>
<td></td>
</tr>
<tr>
<td>Margarine</td>
<td></td>
<td>Yogurt</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pear</td>
<td></td>
</tr>
</tbody>
</table>
Almonds Improve Lipids and Lipoproteins

Different lowercase letters within variables indicate treatment differences, $P < 0.05$
*Significantly different than baseline, $P < 0.05$
Almonds do not Increase Non-HDL-C Subparticles

Different lowercase letters within variables indicate treatment differences, P < 0.05
*Significantly different than baseline, P < 0.05
Remnant Lipoproteins were Improved

Different lowercase letters within variables indicate treatment differences, P < 0.05
*Significantly different than baseline, P < 0.05
A total of 190 patients treated with statins after ACS were enrolled in the study. All the patients were followed prospectively for a maximum period of 70 months or until the occurrence of one of the following events: cardiac death, non-fatal myocardial infarction, unstable angina requiring unplanned coronary revascularization, or ischemic stroke.

(Nguyen et al, *Circ J*, 2014)
Almonds Reduced Abdominal Fat and Lean Mass

Different lowercase letters within variables indicate treatment differences, P < 0.05
*Significantly different than baseline, P < 0.05
Almonds also Decreased Waist Circumference

Different lowercase letters within variables indicate treatment differences, $P < 0.05$

*Significantly different than baseline, $P < 0.05$
Conclusions

- Consumption of almonds (1.5 oz./d), in a cholesterol-lowering diet, provides further total and LDL-cholesterol reductions.
- Almond consumption improves lipid and lipoprotein profile which is predictive of cardiovascular disease risk.
- Almonds have a beneficial effect on regional body composition, decreasing both abdominal and leg adiposity.
Effects of Walnuts and Flax on Cholesterol, Vascular Function, and Cardiovascular Response to Stress

Funded by the California Walnut Growers
Nutrient Profiles of Experimental Diets:

<table>
<thead>
<tr>
<th>% of calories as:</th>
<th>Average American Diet</th>
<th>Walnuts + Walnut Oil</th>
<th>Walnuts, Walnut Oil, + Flax Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>50</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>Protein</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total Fat</td>
<td>35</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>• Saturated</td>
<td>13</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>• Monounsaturated</td>
<td>13</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>• Polyunsaturated</td>
<td>9</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Linoleic acid (n-6)</td>
<td>8</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>α-linolenic acid (n-3)</td>
<td>1</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Cholesterol (mg/d)</td>
<td>311</td>
<td>304</td>
<td>305</td>
</tr>
</tbody>
</table>

One meal consumed on-site each day, all other meals and snacks were packed for take-out.
**Study Design**

*Randomized Cross-Over Controlled Feeding*

<table>
<thead>
<tr>
<th>6 weeks</th>
<th>2 weeks</th>
<th>6 weeks</th>
<th>2 weeks</th>
<th>6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Diet</td>
<td>Walnuts + oil</td>
<td>Walnuts + oil + flax</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All meals prepared in a metabolic kitchen – body weight was maintained. Each experimental diet included the same amount of walnuts (37g) and walnut oil (15 g). **For the higher dose ALA diet, 19 g/d of flax oil was added.**

### Effects of Walnuts and Flaxseed on CVD Risk Factors

<table>
<thead>
<tr>
<th></th>
<th>BP (SBP/DBP)</th>
<th>LDL-C</th>
<th>FMD (Endothelial Function)</th>
<th>CRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walnut &amp; Flax Diet$^{1,2}$</td>
<td>-3 / -3*</td>
<td>-14%*</td>
<td>+34%*</td>
<td>-75%*</td>
</tr>
<tr>
<td>Walnut Diet$^1$</td>
<td>-3 / -3*</td>
<td>-14%*</td>
<td>+10%</td>
<td>-45%</td>
</tr>
</tbody>
</table>

* = significant change vs. control diet

A Walnut Diet Improves Endothelial Function in Hypercholesterolemic Subjects

Beneficial effects on cardiovascular health beyond cholesterol-lowering

(Ros et al, *Circulation*, 2004)
Acute Consumption of Whole Walnuts (85 g) Increases Cholesterol Efflux

*Serum from subjects after whole walnut consumption; serum was added as an efflux inducer to culture media after ABCA1 upregulation by cAMP.

Assays conducted by Dr. George Rothblat.

(Berryman et al, J Nutr, 2013)
172 had a secondary end-point event of total cardiovascular disease.

Total cardiovascular disease was defined as the composite of the end points related to atherosclerotic cardiovascular disease and peripheral revascularization or hospitalization for heart failure or atrial fibrillation.

Pistachio Nut Consumption Modifies Systemic Hemodynamics, Increases Heart Rate Variability, and Reduces Ambulatory Blood Pressure in Well-Controlled Type 2 Diabetes: a Randomized Trial

Katherine A. Sauder, PhD; Cindy E. McCrea, MS; Jan S. Ullbrecht, MB BS; Penny M. Kris-Etherton, PhD, RD; Sheila G. West, PhD

**Background**—Managing cardiovascular risk factors is important for reducing vascular complications in type 2 diabetes, even in individuals who have achieved glycemic control. Nut consumption is associated with reduced cardiovascular risk; however, there is mixed evidence about the effect of nuts on blood pressure (BP), and limited research on the underlying hemodynamics. This study assessed the effect of pistachio consumption on BP, systemic hemodynamics, and heart rate variability in adults with well-controlled type 2 diabetes.

**Methods and Results**—We enrolled 30 adults (40 to 74 years) with type 2 diabetes in a randomized, crossover, controlled feeding study. After a 2-week run-in period, participants consumed a low-fat control diet (27% fat) containing low-fat/high-carbohydrate snacks and a moderate-fat diet (33% fat) containing pistachios (20% of total energy) for 4 weeks each, separated by a 2-week washout. Following each diet period, we assessed BP, systemic hemodynamics, and heart rate variability at rest and during acute mental stress, and, in a subset of participants (n=21), 24-hour ambulatory BP. BP at rest and during stress did not differ between treatments. The pistachio diet significantly reduced total peripheral resistance (−3.7±2.9%, \(P=0.004\)), increased cardiac output (3.1±2.3%, \(P=0.002\)), and improved some measures of heart rate variability (all \(P<0.05\)). Systolic ambulatory BP was significantly reduced by 3.5±2.2 mm Hg (\(P=0.046\)) following the pistachio diet, with the greatest reduction observed during sleep (−5.7±2.6 mm Hg, \(P=0.052\)).

**Conclusions**—A moderate-fat diet containing pistachios modestly improves some cardiovascular risk factors in adults with well-controlled type 2 diabetes.

**Clinical Trial Registration**—URL: www.clinicaltrials.gov. Unique identifier: NCT00956735. *(J Am Heart Assoc. 2014;3:e000873 doi: 10.1161/JAHA.114.000873)*

**Key Words:** blood pressure • heart rate variability • hemodynamics • nutrition • type 2 diabetes mellitus
Ambulatory Blood Pressure

Difference: 3.4 mmHg

Difference: 5.7 mmHg

* $P \leq 0.05$

(Sauder et al, *J Am Heart Assoc*, 2014)
Ambulatory blood pressure monitoring is an increasingly important prognostic parameter for cardiovascular disease risk.

- Allows BP readings to be taken across a 24-hour period.
- Using ambulatory blood pressure monitoring to rule out white-coat hypertension prevents patients from being prescribed unnecessary antihypertensive medications.
- Ambulatory blood pressure monitoring also allows measurement of nocturnal BP, an increasingly important prognostic parameter for cardiovascular disease risk.

A non-dipping pattern and nocturnal hypertension are strongly associated with increased cardiovascular morbidity and mortality.

Pistachios Decrease TC and LDL-C

Pistachios Increased the Levels of Functional HDL Particles

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control</th>
<th>1PD*</th>
<th>2PD†</th>
<th>P (diet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LS mean</td>
<td>SE</td>
<td>LS mean</td>
<td>SE</td>
</tr>
<tr>
<td>α-2 HDL (mmol/l)</td>
<td>1.41</td>
<td>0.06</td>
<td>1.39</td>
<td>0.06</td>
</tr>
<tr>
<td>α-1 HDL (mmol/l)</td>
<td>0.47</td>
<td>0.03</td>
<td>0.48</td>
<td>0.03</td>
</tr>
<tr>
<td>Lipoprotein(a) (μmol/l)</td>
<td>0.89</td>
<td>0.01</td>
<td>0.90</td>
<td>0.01</td>
</tr>
</tbody>
</table>

2 Serving/d of Pistachios Increased Cholesterol Efflux Capacity Versus 1 Serving/d of Pistachios in Low CRP Individuals

American Heart Association 2020 Goals (Dietary)

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fruits &amp; Vegetables</strong></td>
<td><strong>Nuts, Legumes, &amp; Seeds</strong></td>
</tr>
<tr>
<td>≥ 4.5 cups/day</td>
<td>≥ 4 servings/week</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td><strong>Processed Meats</strong></td>
</tr>
<tr>
<td>≥ two 3.5 oz. servings/week</td>
<td>none or ≤ 2 servings/week</td>
</tr>
<tr>
<td>(preferably oily fish)</td>
<td></td>
</tr>
<tr>
<td><strong>Fiber-Rich Whole Grains</strong></td>
<td><strong>Saturated Fat</strong></td>
</tr>
<tr>
<td>(≥ 1.1 g of fiber/10 g of CHO</td>
<td>&lt; 7% of total energy intake</td>
</tr>
<tr>
<td>≥ three 1 oz. equivalent</td>
<td></td>
</tr>
<tr>
<td>servings per day)</td>
<td></td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 1500 mg/day</td>
<td></td>
</tr>
<tr>
<td><strong>Sugar-Sweetened Beverages</strong></td>
<td></td>
</tr>
<tr>
<td>≤ 450 kcal (36 oz.)/week</td>
<td></td>
</tr>
</tbody>
</table>

Summary

- There are many dietary recommendations for nuts
- Epidemiologic and clinical trial evidence supports dietary recommendations for nuts
- Multiple mechanisms account for the cardiometabolic benefits of nuts, including benefits on chronic diseases such as CVD, diabetes, metabolic syndrome and biomarkers for disease risk, i.e., lipids/lipoproteins, remnant lipoproteins, cholesterol efflux, blood pressure, visceral adiposity, among others
Nuts and Energy Balance

Richard D. Mattes, MPH, PhD, RD

• **Affiliations:** Purdue University and West Lafayette, IN, USA

• **Disclosure:** Dr. Mattes has received grants/research support and honorarium from Almond Board of California.
Level 1

Epidemiological Evidence
Nut Consumption versus BMI

(Hu et al, *BMJ*, 1998)
Physicians Health Study (N=21,454)

Average Frequency of Dietary Nut Intake

Body Mass Index (kg/m²)

- Rarely/Never
- 1-3X/mo
- 1X/wk
- ≥2X/wk

(Albert et al, Arch Intern Med, 2002)
Level 2
Clinical Evidence
<table>
<thead>
<tr>
<th>Year</th>
<th>Nut Type</th>
<th>Subjects</th>
<th>Duration (months)</th>
<th>Weight Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abby, 1994</td>
<td>Almond/Macadamia</td>
<td>16</td>
<td>0.75</td>
<td>NS</td>
</tr>
<tr>
<td>Spiller, 1998</td>
<td>Almond</td>
<td>48</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Fraser, 2002</td>
<td>Almond</td>
<td>81</td>
<td>6</td>
<td>NS</td>
</tr>
<tr>
<td>Hyson, 2002</td>
<td>Almond</td>
<td>22</td>
<td>1.5</td>
<td>NS</td>
</tr>
<tr>
<td>Jenkins, 2002</td>
<td>Almond</td>
<td>27</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Lovejoy, 2002</td>
<td>Almond</td>
<td>20</td>
<td>1</td>
<td>+&lt;1Kg</td>
</tr>
<tr>
<td>Spiller, 2003</td>
<td>Almond</td>
<td>38</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Sabate, 2003</td>
<td>Almond</td>
<td>25</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Wein, 2003</td>
<td>Almond</td>
<td>65</td>
<td>6</td>
<td>L</td>
</tr>
<tr>
<td>Hollis, 2007</td>
<td>Almond</td>
<td>20</td>
<td>2.5</td>
<td>NS</td>
</tr>
<tr>
<td>Curb, 2000</td>
<td>Macadamia</td>
<td>30</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Garg, 2003</td>
<td>Macadamia</td>
<td>17</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Kris-Etherton, 1999</td>
<td>Peanut</td>
<td>22</td>
<td>0.75</td>
<td>NS</td>
</tr>
<tr>
<td>Alper, 2002</td>
<td>Peanut</td>
<td>15</td>
<td>4.75</td>
<td>NS</td>
</tr>
<tr>
<td>Morgan, 2001</td>
<td>Pecan</td>
<td>19</td>
<td>2</td>
<td>NS</td>
</tr>
<tr>
<td>Rajaram, 2001</td>
<td>Pecan</td>
<td>23</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Edwards, 1999</td>
<td>Pistachio</td>
<td>10</td>
<td>0.75</td>
<td>NS</td>
</tr>
<tr>
<td>Almario, 2001</td>
<td>Walnut</td>
<td>18</td>
<td>1.5</td>
<td>NS</td>
</tr>
<tr>
<td>Sabate, 1993</td>
<td>Walnut</td>
<td>19</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Zambon, 2000</td>
<td>Walnut</td>
<td>49</td>
<td>1.5</td>
<td>NS</td>
</tr>
<tr>
<td>Iwamoto, 2002</td>
<td>Walnut</td>
<td>80</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Sabate, 2005</td>
<td>Walnut</td>
<td>90</td>
<td>6</td>
<td>+0.4Kg</td>
</tr>
</tbody>
</table>
Level 3
Mechanistic Evidence
Mechanisms

• Appetite
• Energy yield
• Energy Expenditure
Appetite
Appetitive Effects of Nuts

• **Suppress Hunger:**
  • Eating initiation

• **Suppress Desire to eat:**
  • Eating in the absence of hunger

• **Fullness:**
  • Meal size
Healthy Snacks

Can the right snack have an impact on satiety and reduce energy intake?

A (28g almonds)  B (42g almonds)
Factors Contributing to Satiety

- Energy
- Fatty Acids
- Rheology
- Macronutrient Profile
- Fiber
- Cognition
The *Satiety* value of nuts appears to stem from the synergy of their components.
## Dietary Compensation

<table>
<thead>
<tr>
<th>Study</th>
<th>Nut</th>
<th>% Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser et al., 2002</td>
<td>Almonds</td>
<td>54%, 75%</td>
</tr>
<tr>
<td>LoveJoy et al., 2002</td>
<td>Almonds</td>
<td>63%</td>
</tr>
<tr>
<td>Hollis &amp; Mattes</td>
<td>Almonds</td>
<td>76%</td>
</tr>
<tr>
<td>Curb et al., 1992</td>
<td>Macadamia</td>
<td>58%, 113%</td>
</tr>
<tr>
<td>Kirkmeyer &amp; Mattes, 2000</td>
<td>Peanuts</td>
<td>104%</td>
</tr>
<tr>
<td>Alper &amp; Mattes, 2001</td>
<td>Peanuts</td>
<td>66%</td>
</tr>
<tr>
<td>Almario et al., 2001</td>
<td>Walnuts</td>
<td>96%</td>
</tr>
<tr>
<td>Abbey et al., 1994</td>
<td>Walnuts</td>
<td>55%</td>
</tr>
<tr>
<td>Tey et al., 2011</td>
<td>Hazelnuts</td>
<td>100%</td>
</tr>
</tbody>
</table>
100 kcal Daily Load
-70 kcal – Dietary Compensation
30 kcal
Energy Expenditure
Resting Energy Expenditure

Before Peanut Consumption

After Peanut Consumption

kJ/d

0

1000

2000

3000

4000

5000

6000

7000

8000

a

b
Figure 1 – Median REE for lean and overweight participants at baseline and after 8 weeks of peanut oil ingestion. L = lean, O = overweight, M = male, F = female, T = total subjects (male and female). Medians with different letters are significantly different in the same group (p<0.01)
100 kcal Daily Load
- 70 kcal – Dietary Compensation
  30 kcal
- 10 kcal – Increased RMR
  20 kcal
Absorption Efficiency
Inefficient Absorption

Peanuts = 95% dietary fat for 6 d
Pecans = 31% dietary fat for 4 wk
Almonds = 40% dietary fat for 4 wk
Almonds approx 30-45% dietary fat for 3 d
Inefficient Absorption

7-9 day controlled diet with 70 g of peanuts/peanut butter/peanut flour/peanut oil

Almond Particle Size after Mastication
By Number of Chews

Fecal Fat and Energy Lost
By Number of Chews

100 kcal Daily Load
-70 kcal – Dietary Compensation
30 kcal
-10 kcal – Increased RMR
20 kcal
-20 kcal – Fecal Loss
~0
Nuts and Energy Balance

<table>
<thead>
<tr>
<th>Component of Energy Balance</th>
<th>% Almond Energy Dissipated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted body weight gain (kg)</td>
<td>3.1</td>
</tr>
<tr>
<td>Actual body weight gained (kg)</td>
<td>0</td>
</tr>
<tr>
<td>Dietary compensation (KJ)</td>
<td>802</td>
</tr>
<tr>
<td>Fecal excretion (KJ)</td>
<td>84</td>
</tr>
<tr>
<td>Energy Expenditure (KJ)</td>
<td></td>
</tr>
<tr>
<td>REE</td>
<td>184</td>
</tr>
<tr>
<td>TEF</td>
<td>13</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>-79</td>
</tr>
<tr>
<td>Total Energy (DLW)</td>
<td>180</td>
</tr>
<tr>
<td>Total Energy Explained</td>
<td>95</td>
</tr>
</tbody>
</table>

(Hollis and Mattes, *Br J Nutr*, 2007)
Change of Palatability

Time

N=51

Palatability (0=did not like at all, 10=liked extremely)

Week 2  Week 4  Week 6  Week 8  Week 10  Week 12

Single
Variety
All
Insula Activation

T-stat

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significance indicator
Study Design

- Four-week randomized, controlled, parallel-arm
- Healthy adults with increased risk for T2DM
  - 18 – 60 y-o, non-diabetic
  - Overweight (BMI>25) and/or family history
- Five study groups:
  - Control (CL), Meal (BF & LN), Snack (MS & AS)
Almond Consumption and Energy Intake

Almond Consumption and Body Weight

iAUC of glycemic response at 60 and 120 minutes after each eating event

Note: Darker columns - groups that consumed almonds; lighter columns - groups (combined) that did not consume almonds

<table>
<thead>
<tr>
<th></th>
<th>60-min post-BF</th>
<th>120-min post-BF</th>
<th>60-min post-MS</th>
<th>120-min post-MS</th>
<th>60-min post-LN</th>
<th>120-min post-LN</th>
<th>60-min post-AS</th>
<th>120-min post-AS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td>1538.9</td>
<td>1663.3</td>
<td>-444.4</td>
<td>-1035.6</td>
<td>1852.5</td>
<td>3590.8</td>
<td>-673.3</td>
<td>-2613.3</td>
</tr>
<tr>
<td>No almonds</td>
<td>1960.8</td>
<td>2271.3</td>
<td>-214.0</td>
<td>-613.3</td>
<td>2122.2</td>
<td>4423.8</td>
<td>-412.6</td>
<td>-1605.3</td>
</tr>
</tbody>
</table>
Summary

• Epidemiological, Clinical and mechanistic data indicate nuts pose limited threat to positive energy balance
• Nuts have strong satiety properties and elicit strong compensatory dietary compensation
• Energy absorption from nuts is less than predicted
• Nuts are associated with elevated resting energy expenditure
• Nuts may be a useful snack option
Sharon Palmer, RDN

Disclosure: Sharon provides consultant services for a select group of organizations, including American Pistachio Growers, Daisy Brand Cottage Cheese, SOYJOY, and Tomato Product Wellness Council.
What Are Tree Nuts?

Dry fruits with one seed in which the ovary wall becomes hard at maturity:

- Almonds
- Walnuts
- Cashews
- Pecans
- Pistachios
- Hazelnuts
- Brazil nuts
- Macadamia nuts
- Pine nuts
Nuts and Nutritional Profile

**Nutrient Content of Tree Nuts (1 oz.)**

- **Protein**
- **Fiber**

(USDA, National Nutrient Database, 2015)
Nuts and Nutritional Profile

Fat Content of Tree Nuts (1 oz.)

<table>
<thead>
<tr>
<th></th>
<th>Total Fat</th>
<th>Monosaturated Fat</th>
<th>Polyunsaturated Fat</th>
<th>Saturated Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walnuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cashews</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pecans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pistachios</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazelnuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil nuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macadamia nuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine nuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(USDA, National Nutrient Database, 2015)
## Nuts and Nutritional Profile

<table>
<thead>
<tr>
<th>Nut (1 oz.)</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td>169</td>
</tr>
<tr>
<td>Walnuts</td>
<td>185</td>
</tr>
<tr>
<td>Cashews</td>
<td>155</td>
</tr>
<tr>
<td>Pecans</td>
<td>199</td>
</tr>
<tr>
<td>Pistachios</td>
<td>161</td>
</tr>
<tr>
<td>Hazelnuts</td>
<td>181</td>
</tr>
<tr>
<td>Brazil nuts</td>
<td>185</td>
</tr>
<tr>
<td>Macadamia nuts</td>
<td>203</td>
</tr>
<tr>
<td>Pine nuts</td>
<td>190</td>
</tr>
</tbody>
</table>

(USDA, National Nutrient Database, 2015)
Nutritional Attributes for Nuts

- Nutrient Dense
- Healthy Fats
- Protein
- Fiber
- Vitamins and Minerals
- Phytochemicals
Nutrient Dense

Nature’s unique treasure: packed with healthy fats, fiber, protein, vitamins, minerals, and phytochemicals in a small serving.
Healthy Fats

• High total fat content: 46 – 76% fat
• Ample unsaturated fats: monounsaturated and polyunsaturated fats
• Low in saturated fat (4-16%)
• Helps lower LDL cholesterol; reduce risk of cardiovascular disease
• Omega-3 fatty acids (ALA) also present in walnuts—highest content in all edible plants

(Ros, Nutrients, 2010)
Protein

- Good plant-based high quality protein source (about 25% of energy)
- Some richer in protein: almonds, pistachios 6 grams per ounce
- High in L-Arginine: amino acid converted to nitric oxide in the body; helps keep blood vessels elastic, thereby reducing the risk of atherosclerosis, found in walnuts, almonds, cashews, and pistachios

(Ros, *Nutrients*, 2010)
• Fiber (4-11 grams per 100 grams); 5-10% DV for fiber in one standard serving; primarily insoluble fiber

• Plant sterols and stanols, components of plant membranes resemble chemical structure of cholesterol; only obtained through plant sources; lower blood cholesterol by blocking its absorption by competing for cholesterol in gut

(Ros, *Nutrients*, 2010; International Food Information Council Foundation, 2014)
Vitamins and Minerals

Range of micronutrients, depending on nut:

- vitamins B6, E (important source; almonds, hazelnuts) and K, riboflavin, thiamin

- copper, manganese, magnesium, iron, selenium, zinc, calcium, phosphorus

(USDA, National Nutrient Database, 2015)
Phytochemicals

• Bioactive compounds in plants, possess antioxidant and anti-inflammatory activity

• Concentrated in nuts; high in antioxidant capacity; i.e. walnuts and pistachios rank high

• Range:
  • flavonoids (quercetin, kaempferol, rutin)
  • phenolic compounds (proanthocyanidins)
  • isoflavonoids
  • carotenoids (lutein, zeaxanthin in pistachios)
  • stilbenes (resveratrol in pistachios)

(Ros, *Nutrients*, 2010)
Recommended Serving

• Research supports: 1 – 1 ½ ounces per day, about one handful

• FDA Qualified Health Claim
  “Scientific evidence suggests but does not prove that eating 1.5 ounces per day of most nuts, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease.” (US FDA, 2014)

• Nuts and seeds recommended 4 – 7 ounces per week by DGAC 2015
RDs Can Help!
Adding a daily dose of nuts is good nutrition advice:

- For all age groups, from young to old
- Perfect easy, whole foods snack
- No fuss, preparation, minimal packaging
- Great for packing away in lunchboxes, backpacks, and purses
- Healthy plant-based protein source
RDs Can Help!

Adding a daily dose of nuts is good nutrition advice:

• Health benefits, such as CVD, weight management, and blood glucose control
• Nutrient-rich eating
• Fits in many meal plans, from gluten-free to vegetarian
• Nuts are healthy indulgence, they make everything feel and taste better: salads, yogurts, cereals, sandwiches, baked goods, and beyond
Tips for Boosting Nuts

1. Find nuts you like and stock them on hand.
2. Maintain freshness by freezing if you won’t use quickly.
3. Portion out one-ounce servings for work, on-the-go, and lunchboxes.
4. Use nuts in baked goods: cookies, muffins, breads, pancakes.
5. Sprinkle nuts on morning cereal.
Tips for Boosting Nuts

- Stir nuts into stir-fries
- Toss nuts into salads for crunch and nutrition
- Make homestyle trail mixes with your favorite nuts and dried fruits
- Enjoy nuts sprinkled over yogurt or cottage cheese and fruit
- Use nut butters as a spread, in baking, in sauces and on sandwiches
Getting Nutty on the Menu

1. Breakfast
2. Lunch
3. Dinner
4. Snacks
Breakfast

- Add chopped nuts to breakfast cereal, such as oatmeal, porridge, granola, or cold cereal
- Add chopped nuts to quick breads, such as pecan pancakes, walnut waffles, blueberry hazelnut muffins, or pistachio orange biscuits
- Sprinkle nuts, such as almonds, pistachios or brazil nuts over Greek yogurt with fruit for an easy breakfast
- Spread nut butter, such as almond, walnut, or cashew butter over toast, bagels, or English muffins
Lunch

• Use nut butter, such as almond or cashew butter, as a spread on sandwiches instead of margarine or mayo; even savory sandwiches!

• Toss nuts into salads, such as romaine salad with toasted walnuts, kale salad with almonds, or 3-bean salad with pinenuts

• Make a simple meal of cottage cheese, seasonal fruit and nuts, such as pistachios, almonds, macadamia nuts and pecans

• Enjoy an Asian vegetable stir-fry with a sprinkling of nuts, such as almonds
• Add nut butter to savory sauces, such as curry, mole, or Thai sauce

• Sprinkle nuts, such as pistachios, macadamia, walnuts, or almonds into sautéed vegetables, such as spinach, asparagus or Brussels sprouts, as a side dish

• Top lean proteins with herbs and chopped nuts, such as pine nuts, hazelnuts, cashews, or pistachios and roast

• Whiz up a pesto sauce with basil, garlic, EVOO, and nuts, such as almonds, pine nuts, pistachios or walnuts

• Mix finely diced nuts into bread crumb toppings for casseroles, such as macaroni and cheese, broccoli cheese, or green bean casserole for a nutritious crunch
Dinner

- Press chopped nuts, such as walnuts, pecans and hazelnuts into veggie-burgers or nut-loafs as a meat alternative
- Toss cooked whole grain pasta with tomatoes, EVOO, garlic and nuts, such as pinenuts, pistachios, and walnuts
- Stir chopped nuts, such as almonds, pinenuts, and Brazil nuts into whole grain side-dishes, such as rice pilaf, couscous, and farro
- Soak cashews overnight and blend into a cashew cream for cooking
Snacks

- Dip apples in nut butter and top with coconut flakes and dark chocolate chips/raisins
- Serve vegetable crudités with nut butter
- Roast raw nuts, such as cashews, almonds or walnuts in the oven with EVOO, rosemary, sea salt and cayenne pepper
- Sprinkle chopped nuts, such as pistachios, hazelnuts, or macadamia nuts on top of plain non-fat Greek yogurt with berries
- Add nuts such as almonds, hazelnuts, cashews or walnuts to smoothies with fruit, milk and greens
Credit Claiming

You must complete a brief evaluation of the program in order to obtain your certificate. The evaluation will be available for 3 months; you do not have to complete it today.

Credit Claiming Instructions:

1. Go to [www.CE.TodaysDietitian.com/TreeNuts](http://www.CE.TodaysDietitian.com/TreeNuts) OR Log in to [www.CE.TodaysDietitian.com](http://www.CE.TodaysDietitian.com) and go to My Account → My Activities → Courses (in Progress) and click on the webinar title.

2. Click “Continue” on the webinar description page. Note: You must be logged-in to see the “Continue” button.

3. Select the Evaluation icon to complete and submit the evaluation.

4. Download and print your certificate.

Please Note: If you access the Evaluation between 3-4 pm ET on 3-19 you may experience a slow connection due to a high volume of users.