

*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




Complimentary 1-Credit Continuing Education Webinar

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### Nuts and Clinical Trials, Mechanisms and Recommendations 2



**Penny Kris-Etherton, PhD, RD, FAHA**

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

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### Outline 3

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

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## WHO - The Global Burden of Disease Study <sup>4</sup>

THE WORLD'S TOP 12 HEALTH PROBLEMS		
Ranked by Disability-Adjusted Life Years (DALYs)		
Rank	1990	2010
1	Lower respiratory infection	Ischemic heart disease
2	Diarrhea	Lower respiratory infection
3	Preterm birth	Stroke
4	Ischemic heart disease	Diarrhea
5	Stroke	HIV
6	COPD	Low back pain
7	Malaria	Malaria
8	Tuberculosis	COPD
9	Protein, energy malnutrition	Preterm birth
10	Neonatal encephalitis	Road injury
11	Low back pain	Major depressive disorders
12	Road injury	Neonatal encephalitis

■ Communicable, neonatal/maternal disease  
■ Noncommunicable disease  
■ Injury

(Cohen, *Science*, 2012)

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## WHO - The Global Burden of Disease Study <sup>5</sup>

THE TOP 12 RISK FACTORS		
Factors Causing the Greatest "Loss of Health"		
Rank	1990	2010
1	Low body weight	High blood pressure
2	Household air pollution	Smoking
3	Smoking	Alcohol
4	High blood pressure	Household air pollution
5	Lack of breastfeeding	Low fruit consumption
6	Alcohol	High body mass index
7	Ambient particulate matter	High fasting plasma glucose
8	Low fruit consumption	Low body weight
9	High fasting plasma glucose	Ambient particulate matter
10	High body mass index	Inactivity
11	Low iron intake	High salt intake
12	High salt intake	Low nut/seed consumption

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

(Cohen, *Science*, 2012)

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## Healthy Dietary Patterns <sup>6</sup>

- 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)

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## Actions for Individuals and Families/Households

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- 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.**

(USDA, *Scientific Report of the 2015 DGAC*, 2015)

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## Chapter 4: Foods and Nutrients to Increase

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### 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.<sup>48</sup>

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)

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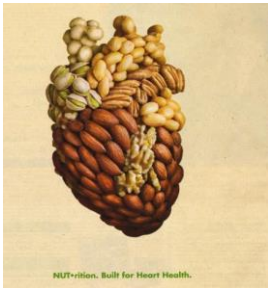
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## CVD Benefits of Nut & Peanut Consumption

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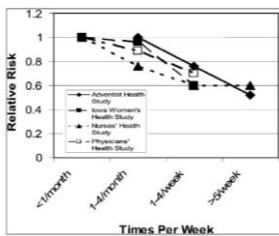
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### Frequency of Nut Consumption Reduces CHD Risk in a Dose-Response Manner

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Results are from four epidemiologic studies

(USDA, *Scientific Report of the 2015 DGAC*, 2015; Sabaté and Ang, *Am J Clin Nutr*, 2009)

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

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#### Frequency of Walnut Consumption

	Never/Rarely	< 1 Sv/Wk	1 Sv/Wk	≥ 2 Sv/Wk	P-Trend
Multivariate Model + BMI	1.00	0.96 (0.90-1.02)	0.87 (0.75-1.01)	0.76 (0.62-0.94)	0.002

(Pan et al, *J Nutr*, 2013)

Table 2. Association of Nut and Peanut Butter Intake With Total Mortality in the SCCS and Peanut Intake With Total Mortality in the SMHS/SWHS<sup>a</sup>

Total Mortality Quintile	Total <sup>b</sup>		Men <sup>c</sup>		Women <sup>c</sup>	
	No. of Deaths	Adjusted HR (95% CI)	No. of Deaths	Adjusted HR (95% CI)	No. of Deaths	Adjusted HR (95% CI)
<b>Nut Intake Only (SCCS)</b>						
1	1767	1 [Reference]	791	1 [Reference]	576	1 [Reference]
2	1543	0.92 (0.85-0.99)	955	0.88 (0.80-0.98)	588	0.83 (0.74-0.93)
3	801	0.81 (0.74-0.88)	352	0.76 (0.66-0.87)	449	0.84 (0.75-0.95)
4	1190	0.78 (0.72-0.84)	716	0.72 (0.64-0.81)	474	0.77 (0.68-0.87)
5	955	0.73 (0.67-0.79)	518	0.70 (0.62-0.79)	437	0.75 (0.66-0.85)
P value for trend <.001						
<b>Peanut Intake (SMHS/SWHS)</b>						
1	2328	1 [Reference]	1035	1 [Reference]	1293	1 [Reference]
2	1121	0.81 (0.76-0.88)	282	0.87 (0.76-1.00)	839	0.80 (0.73-0.87)
3	1393	0.78 (0.73-0.84)	467	0.77 (0.69-0.87)	926	0.79 (0.72-0.86)
4	1786	0.81 (0.76-0.86)	816	0.82 (0.75-0.91)	970	0.80 (0.73-0.87)
5	1516	0.83 (0.77-0.88)	787	0.83 (0.75-0.91)	729	0.83 (0.75-0.91)
P value for trend <.001						

(Luu et al, *JAMA Intern Med*, 2015)

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2013;368:1279-1290  
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

## 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\*

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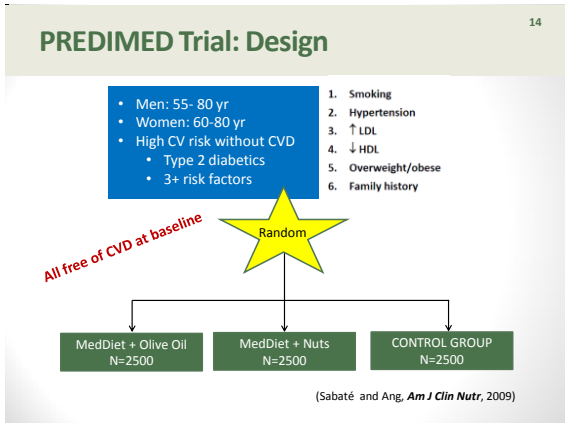
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### Primary Prevention of Cardiovascular Disease with a Mediterranean Diet: The PREDIMED Trial

- 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.

(Estruch et al, *N Engl J Med*, 2013)

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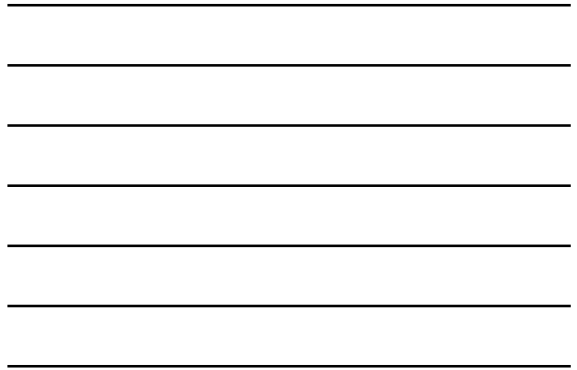
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**Intake of Energy and Nutrients at the End of the Trial by Study Group**

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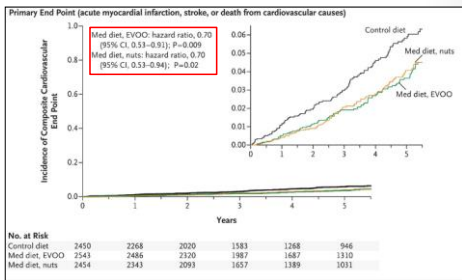
Variable	MedDiet + EVOO	MedDiet + Nuts	Control
Energy, kcal	2172	2229	1960
CHO, % E	40	40	44
Fat, % E	41	42	37
SFA, % E	9	9	9
MUFA, % E	22	21	19
PUFA, % E	6	8	6
Linoleic acid, g/d	12	16	10
ALA, g/d	1.3	1.5	1.3
Marine n-3 FA, g/d	0.9	0.8	0.7

(Estruch et al, *N Engl J Med*, 2013)



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

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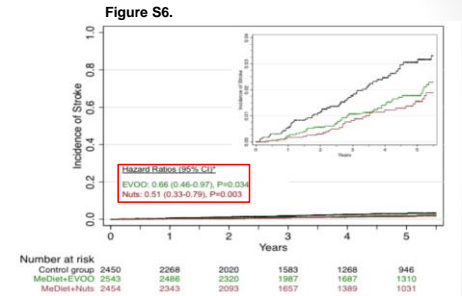


(Estruch et al, *N Engl J Med*, 2013)



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

18



(Estruch et al, *N Engl J Med*, 2013)



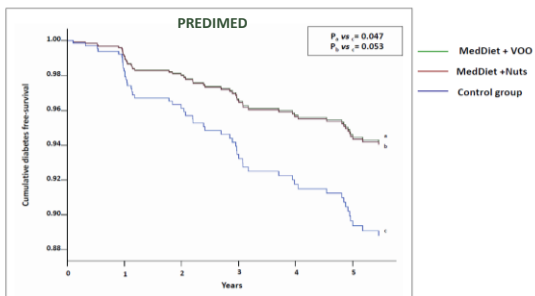
## Recent Evidence from PREDIMED: Further Benefits of Olive Oil and Nuts

19

- 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

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(Salas-Salvado et al, *Diabetes Care*, 2011)

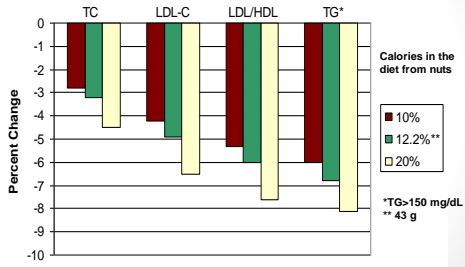
## Recent Evidence from PREDIMED: Further Benefits of Olive Oil and Nuts

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- 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)
  - Increased nut consumption reduced risk for obesity, MetS, diabetes, and abdominal obesity. (Ibarrola-Jurado et al, *PLoS One*, 2013)
  - 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 <sup>22</sup> 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)

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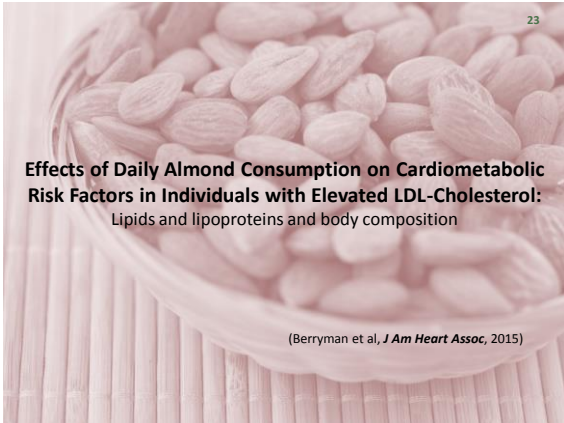
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## Effects of Daily Almond Consumption on Cardiometabolic Risk Factors in Individuals with Elevated LDL-Cholesterol: Lipids and lipoproteins and body composition

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

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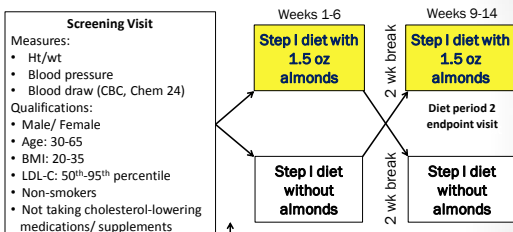
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## Experimental Design



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

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### Diet Design: Sample Menu 25

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

Breakfast:	Snack:	Lunch:	Dinner:
<ul style="list-style-type: none"> <li>• 2% milk</li> <li>• Oatmeal</li> <li>• Apple juice</li> <li>• English muffin</li> <li>• Blueberries</li> <li>• Margarine</li> </ul>	<p>1.5 oz. almonds</p> <p>OR</p> <p>106 g banana muffin</p>	<ul style="list-style-type: none"> <li>• White bread</li> <li>• Deli turkey</li> <li>• Provolone cheese</li> <li>• Mayonnaise</li> <li>• Pretzels</li> <li>• Yogurt</li> <li>• Pear</li> </ul>	<ul style="list-style-type: none"> <li>• Chicken parmesan</li> <li>• Broccoli</li> <li>• Dinner roll</li> <li>• Margarine</li> </ul>

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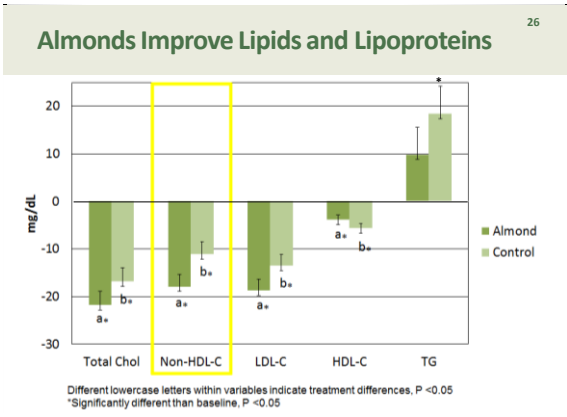
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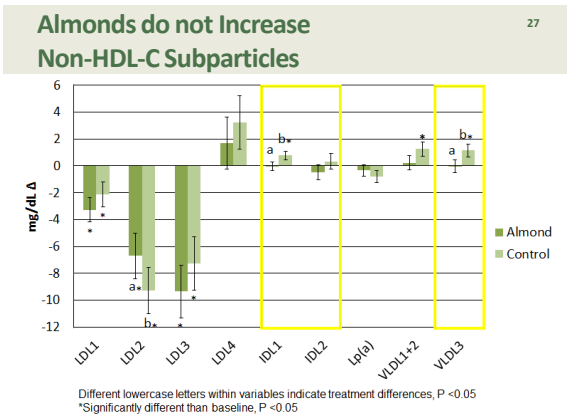
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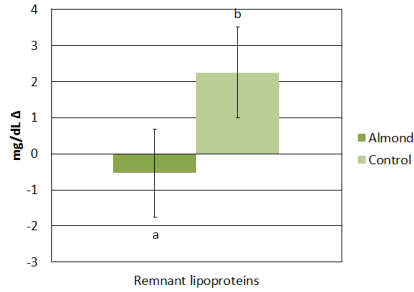
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## Remnant Lipoproteins were Improved

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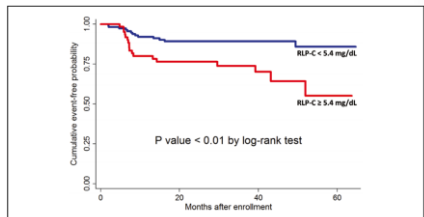


Different lowercase letters within variables indicate treatment differences,  $P < 0.05$   
 \*Significantly different than baseline,  $P < 0.05$



## High Remnant Lipoprotein Predicts Recurrent Cardiovascular Events on Statin Treatment After Acute Coronary Syndrome

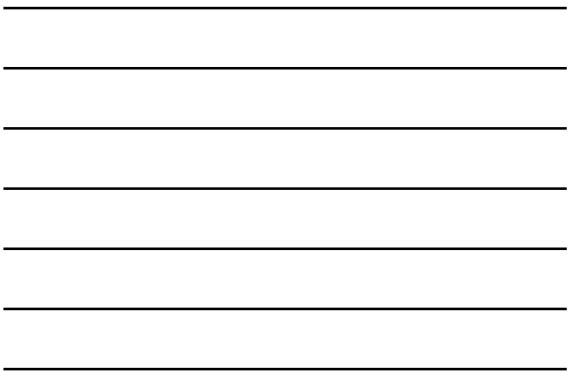
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**Figure 1.** Kaplan-Meier analysis according to remnant-like lipoprotein particle cholesterol (RLP-C). The cut-off value of 5.4 mg/dL was chosen based on receiver operating characteristic curve analysis of the entire patient study group.

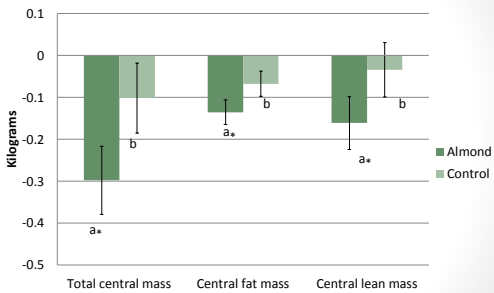
A total of 190 patients treated with statins after ACS were enrolled in the study. All the patients were followed prospectively for a maximum period of 70 months or until the occurrence of one of the following events: cardiac death, non-fatal myocardial infarction, unstable angina requiring unplanned coronary revascularization, or ischemic stroke.

(Nguyen et al, *Circ J*, 2014)



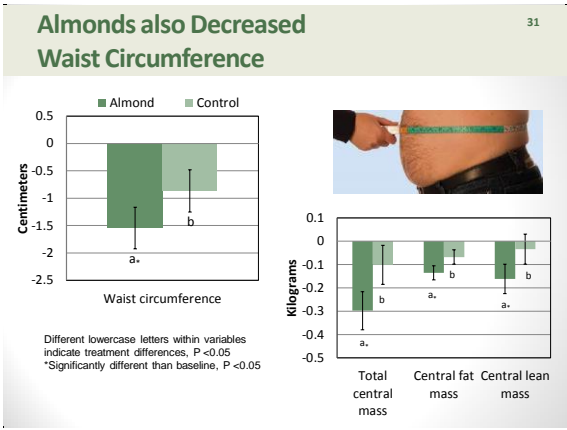
## Almonds Reduced Abdominal Fat and Lean Mass

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Different lowercase letters within variables indicate treatment differences,  $P < 0.05$   
 \*Significantly different than baseline,  $P < 0.05$






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- ### Conclusions
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- 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
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### Effects of Walnuts and Flax on Cholesterol, Vascular Function, and Cardiovascular Response to Stress

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Funded by the California Walnut Growers  
(Zhao et al, *J Nutr*, 2004; West et al, *J Am Coll Nutr*, 2010)

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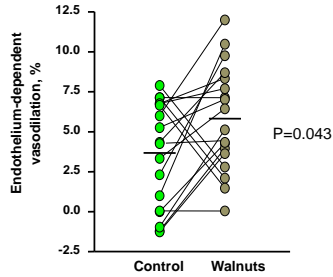
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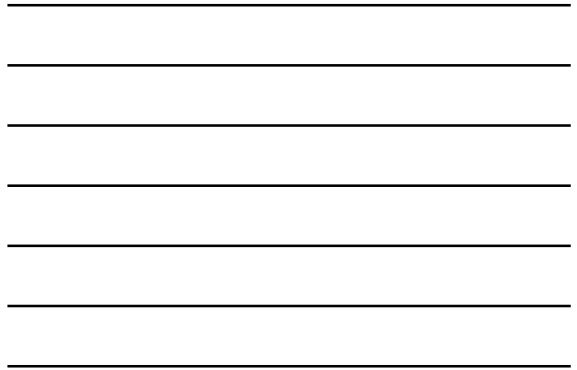


### A Walnut Diet Improves Endothelial Function in Hypercholesterolemic Subjects 37

Beneficial effects on cardiovascular health beyond cholesterol-lowering

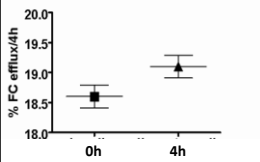


(Ros et al, *Circulation*, 2004)

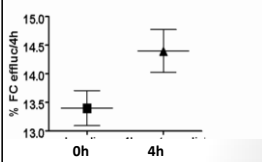


### Acute Consumption of Whole Walnuts (85 g) Increases Cholesterol Efflux 38

J774 cells (upregulated with cAMP) incubated with 2.5% sera from individuals fed whole walnut



J774 cells (upregulated with cAMP) incubated with 3.5% apo B depleted sera from individuals fed whole walnut



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

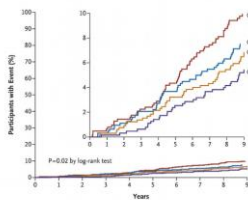
Assays conducted by Dr. George Rothblat.

(Berryman et al, *J Nutr*, 2013)



### Kaplan–Meier Curves and Hazard Ratios for Cardiovascular Events, According to Quartile of Cholesterol Efflux Capacity 39

B Total Cardiovascular Disease



Quartile	Hazard Ratio Unadjusted	Hazard Ratio Adjusted
Q1	0.75 (0.51-1.10)	0.74 (0.50-1.09)
Q2	0.65 (0.44-0.97)	0.58 (0.37-0.92)
Q3	0.52 (0.34-0.80)	0.42 (0.27-0.65)
Q4	Reference	Reference

- 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.

(Rohatgi et al, *N Engl J Med*, 2014)



### 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. Ulbrecht, 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±2.3%, 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).

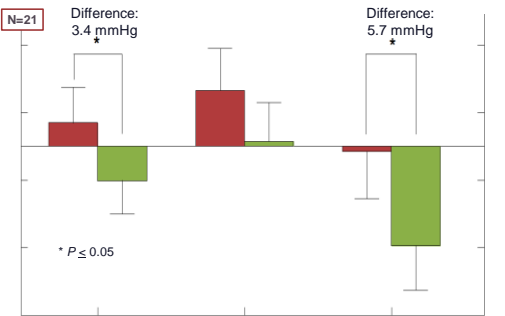
**Conclusions**—A moderate-fat diet containing pistachios modestly improves some cardiovascular risk factors in adults with well-controlled type 2 diabetes.

**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

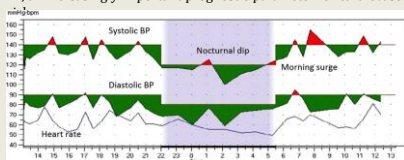


(Sauder et al, *J Am Heart Assoc*, 2014)



### Ambulatory blood pressure monitoring is an increasingly important prognostic parameter for cardiovascular disease risk.

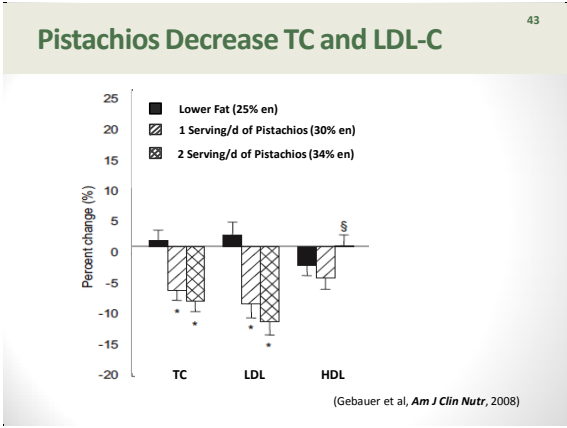
- Allows BP readings to be taken across a 24-hour period.
- Using ambulatory blood pressure monitoring to rule out white-coat hypertension prevents patients from being prescribed unnecessary antihypertensive medications.
- Ambulatory blood pressure monitoring also allows measurement of nocturnal BP,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



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

(Turner et al, *Am J Med*, 2015)






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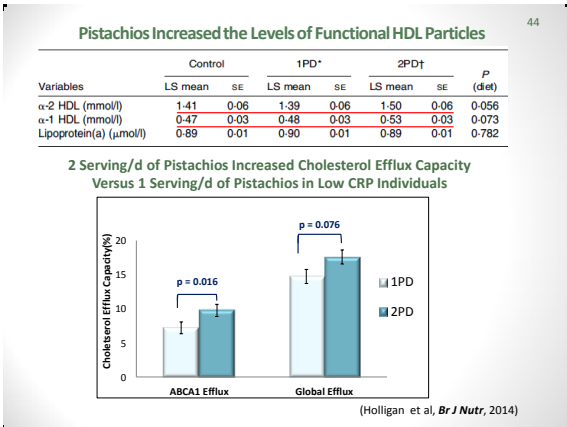
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### American Heart Association 2020 Goals (Dietary)

45

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

(Lloyd-Jones et al, *Circulation*, 2010)

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46

### 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



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47

### 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.

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48

## Level 1

### Epidemiological Evidence

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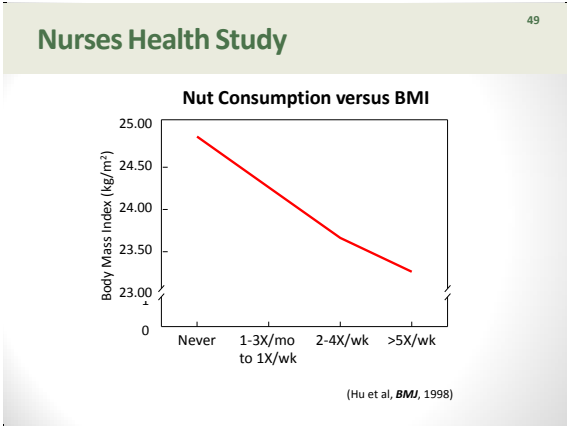
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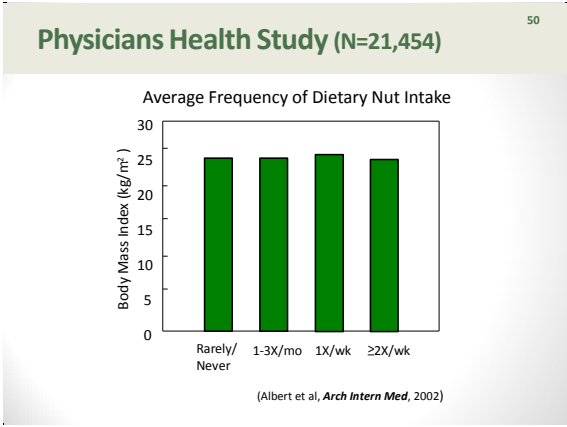
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## Level 2

### Clinical Evidence

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Nuts and Weight Change

	Nut	Subjects	Duration (months)	Weight Change
Abby, 1994	Almond/Macadamia	16	0.75	NS
Spiller, 1998	Almond	48	1	NS
Fraser, 2002	Almond	81	6	NS
Hyson, 2002	Almond	22	1.5	NS
Jenkins, 2002	Almond	27	1	L
Lovejoy, 2002	Almond	20	1	+<1Kg
Spiller, 2003	Almond	38	1	NS
Sabate, 2003	Almond	25	1	NS
Wein, 2003	Almond	65	6	L
Hollis, 2007	Almond	20	2.5	NS
Curb, 2000	Macadamia	30	1	NS
Garg, 2003	Macadamia	17	1	L
Kris-Etherton, 1999	Peanut	22	0.75	NS
Alper, 2002	Peanut	15	4.75	NS
Morgan, 2001	Pecan	19	2	NS
Rajaram, 2001	Pecan	23	1	L
Edwards, 1999	Pistachio	10	0.75	NS
Almario, 2001	Walnut	18	1.5	NS
Sabate, 1993	Walnut	19	2	L
Zambon, 2000	Walnut	49	1.5	NS
Iwamoto, 2002	Walnut	80	1	L
Sabate, 2005	Walnut	90	6	+0.4Kg

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53

## Level 3

### Mechanistic Evidence

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54

## Mechanisms

- Appetite
- Energy yield
- Energy Expenditure




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55

# Appetite

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56

## Appetitive Effects of Nuts

- **Suppress Hunger:**
  - Eating initiation
- **Suppress Desire to eat:**
  - Eating in the absence of hunger
- **Fullness:**
  - Meal size



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57

## Healthy Snacks

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



A (28g almonds)



B (42g almonds)

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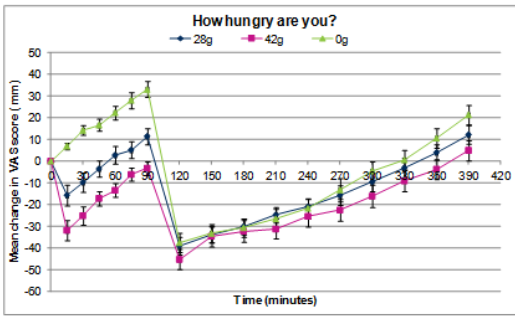
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(Hull et al, *Eur J Nutr*, 2014)

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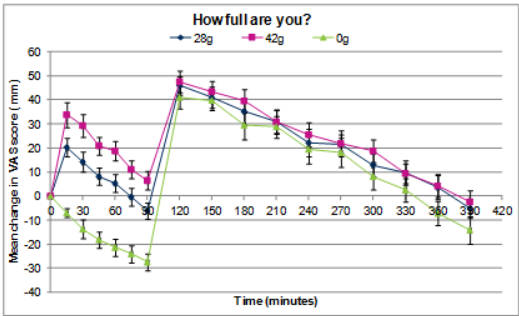
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(Hull et al, *Eur J Nutr*, 2014)

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60

### Factors Contributing to Satiety

- Energy
- Fatty Acids
- Rheology
- Macronutrient Profile
- Fiber
- Cognition



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61

The **Satiety** value of nuts  
appears to stem from the  
synergy of their  
components

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## Dietary Compensation

62

Study	Nut	% Compensation
Fraser et al., 2002	Almonds	54%, 75%
LoveJoy et al., 2002	Almonds	63%
Hollis & Mattes	Almonds	76%
Curb et al., 1992	Macadamia	58%, 113%
Kirkmeyer & Mattes, 2000	Peanuts	104%
Alper & Mattes, 2001	Peanuts	66%
Almario et al., 2001	Walnuts	96%
Abbey et al., 1994	Walnuts	55%
Tey et al., 2011	Hazelnuts	100%

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63

**100** kcal Daily Load  
**- 70** kcal – Dietary Compensation  
**30** kcal

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64

# Energy Expenditure

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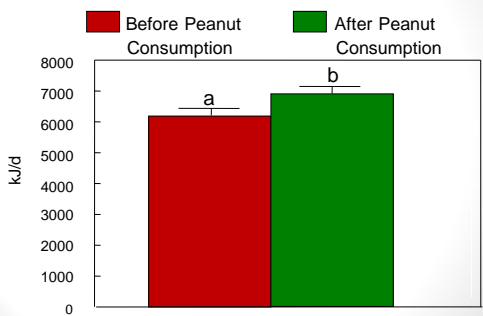
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65

## Resting Energy Expenditure




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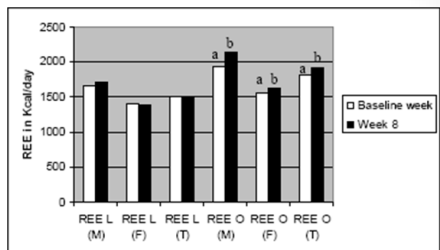
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66

## Resting Energy Expenditure



**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)

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67

**100** kcal Daily Load  
- 70 kcal – Dietary Compensation  
**30** kcal  
- 10 kcal – Increased RMR  
**20** kcal

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68

## Absorption Efficiency

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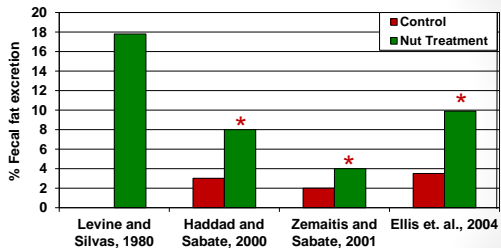
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69

## Inefficient Absorption



Peanuts= 95% dietary fat for 6 d

Pecans=31% dietary fat for 4wk

Almonds= 40% dietary fat for 4wk

Almonds approx 30-45% dietary fat for 3 d

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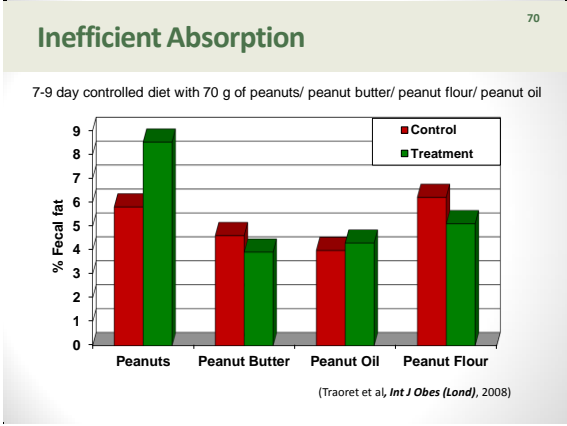
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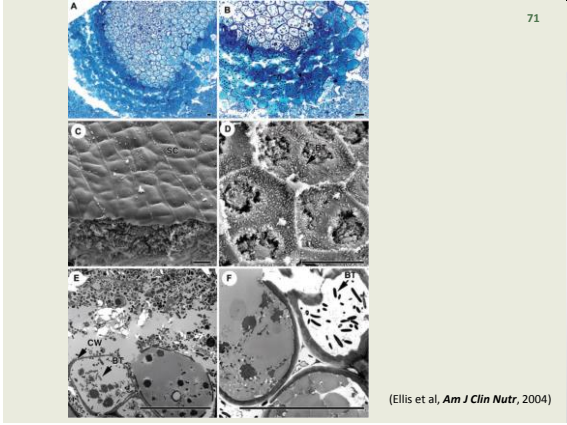
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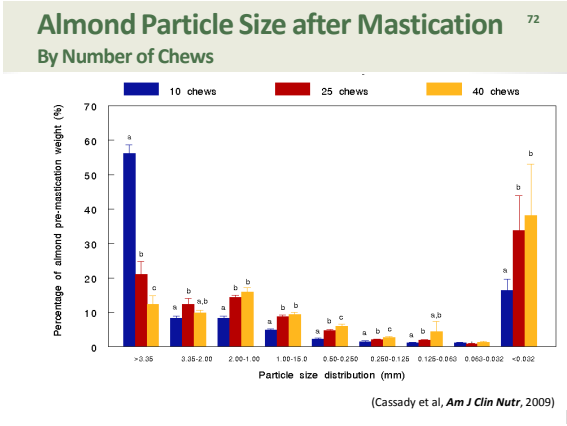
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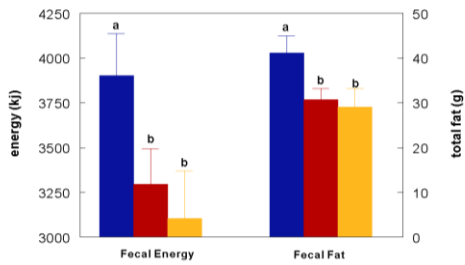
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### Fecal Fat and Energy Lost By Number of Chews

73



(Cassady et al, *Am J Clin Nutr*, 2009)

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

74

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### Nuts and Energy Balance

75

	Component of Energy Balance	% Almond Energy Dissipated
Predicted body weight gain (kg)	3.1	
Actual body weight gained (kg)	0	
Dietary compensation (KJ)	802	74
Fecal excretion (KJ)	84	7
Energy Expenditure (KJ)		
REE	184	13
TEF	13	.01
Physical Activity	-79	-6
Total Energy (DLW)	180	14
<b>Total Energy Explained</b>		<b>95</b>

(Hollis and Mattes, *Br J Nutr*, 2007)

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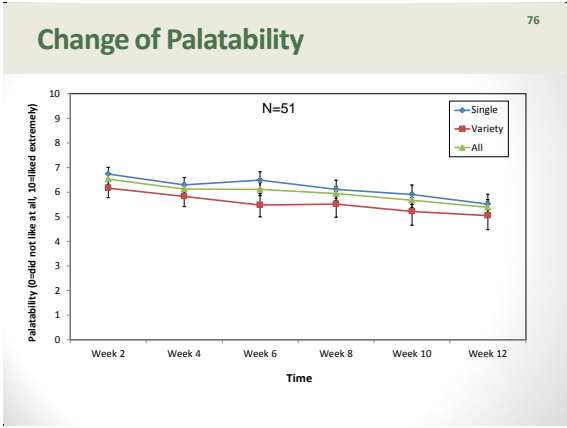
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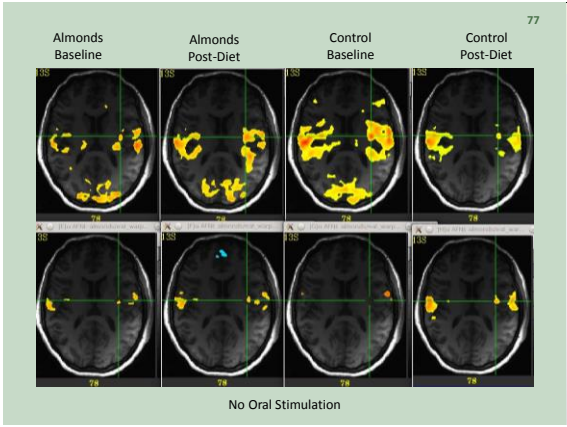
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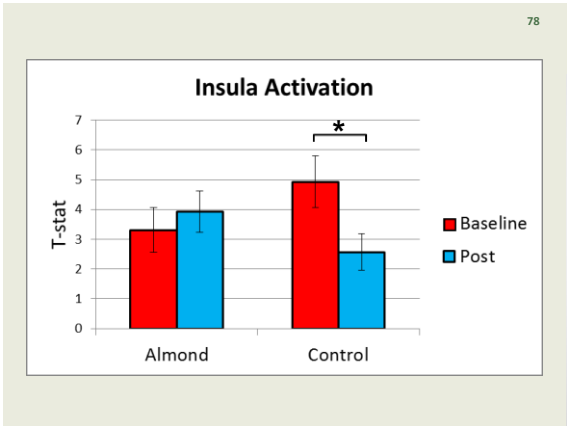
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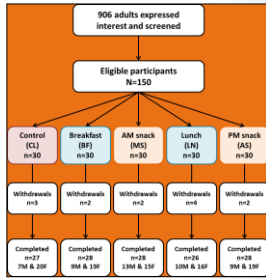
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## Study Design

79

- 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)**



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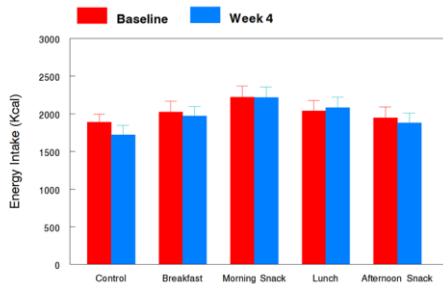
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## Almond Consumption and Energy Intake

80



(Tan and Mattes, *Eur J Clin Nutr*, 2013)

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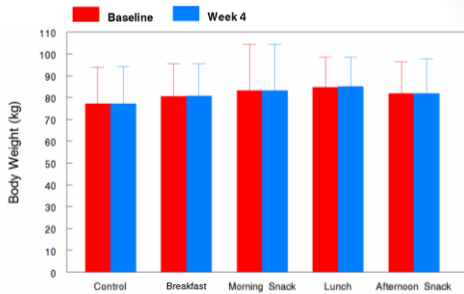
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## Almond Consumption and Body Weight

81



(Tan and Mattes, *Eur J Clin Nutr*, 2013)

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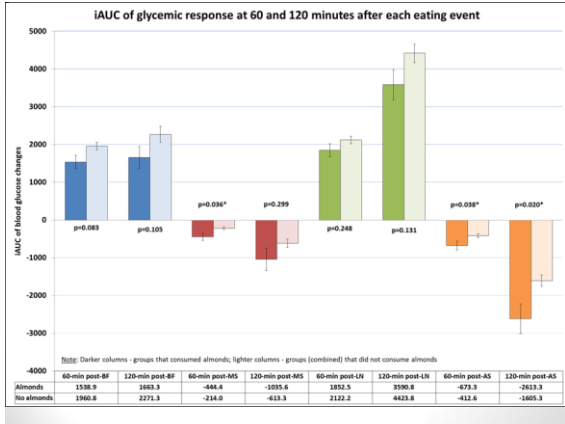
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## Summary 83

- 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




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## Nuts and Healthy Diet 84



**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.

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## What Are Tree Nuts? 85

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




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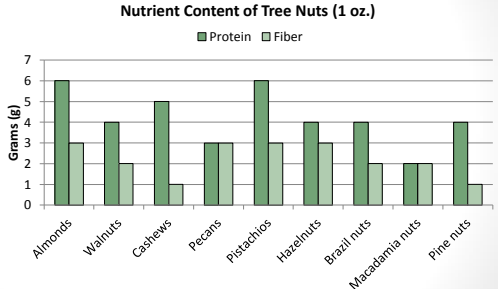
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## Nuts and Nutritional Profile 86

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



Nut	Protein (g)	Fiber (g)
Almonds	6.0	3.0
Walnuts	4.0	2.0
Cashews	5.0	1.0
Pecans	3.0	3.0
Pistachios	6.0	3.0
Hazelnuts	4.0	3.0
Brazil nuts	4.0	2.0
Macadamia nuts	2.0	2.0
Pine nuts	4.0	1.0

(USDA, National Nutrient Database, 2015)

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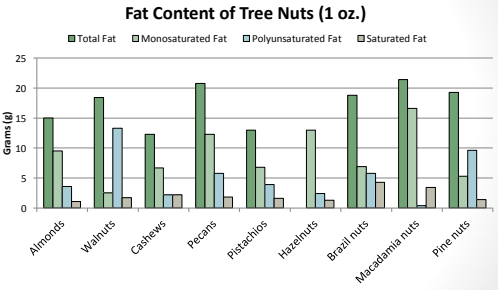
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## Nuts and Nutritional Profile 87

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



Nut	Total Fat (g)	Monosaturated Fat (g)	Polyunsaturated Fat (g)	Saturated Fat (g)
Almonds	15.0	9.0	5.0	1.0
Walnuts	18.0	13.0	4.0	1.0
Cashews	12.0	6.0	5.0	1.0
Pecans	20.0	12.0	8.0	1.0
Pistachios	13.0	6.0	5.0	2.0
Hazelnuts	13.0	1.0	11.0	1.0
Brazil nuts	18.0	6.0	10.0	2.0
Macadamia nuts	21.0	16.0	5.0	1.0
Pine nuts	19.0	9.0	10.0	1.0

(USDA, National Nutrient Database, 2015)

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### Nuts and Nutritional Profile

88

Nut (1 oz.)	Calories
Almonds	169
Walnuts	185
Cashews	155
Pecans	199
Pistachios	161
Hazelnuts	181
Brazil nuts	185
Macadamia nuts	203
Pine nuts	190



(USDA, National Nutrient Database, 2015)

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### Nutritional Attributes for Nuts

89

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



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### Nutrient Dense

90

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



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## Healthy Fats

91

- 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)

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## Protein

92

- 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)

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## Fiber

93

- 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)

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## Vitamins and Minerals

94

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)

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## Phytochemicals

95

- 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)

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## Recommended Serving

96

- 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




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### RDs Can Help!

97

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




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### RDs Can Help!

98

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




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### Tips for Boosting Nuts

99

-  Find nuts you like and stock them on hand
-  Maintain freshness by freezing if you won't use quickly
-  Portion out one-ounce servings for work, on-the-go, and lunchboxes
-  Use nuts in baked goods: cookies, muffins, breads, pancakes
-  Sprinkle nuts on morning cereal

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## Tips for Boosting Nuts

100



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

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## Getting Nutty on the Menu

101

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



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## Breakfast

102

- 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



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## 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




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## Dinner

- 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

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105

## 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




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## Snacks

106

- Dip apples in nut butter and top with coconut flakes and dark chocolate chips/raisins
- Serve vegetable crudité's 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




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## Credit Claiming

107

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**

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