



Health and Nutrition Research

Pistachios can help individuals maintain good health, support an active lifestyle and reduce the risk of nutrition-related diseases. Research studies suggest that pistachios have numerous health benefits, including being a source of health-boosting antioxidants and other important nutrients, lowering the risk of heart disease, supporting weight management and a healthy diet, creating a lower-than-expected blood-sugar level and helping with insulin sensitivity.

Subjects who ate more than three servings of nuts (such as pistachios) per week had a **39% lower mortality risk.**

The PREDIMED Study. Guasch-Ferré, et al. BMC medicine 2013Jul16; 11:164

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Pistachios and Mortality

Many large population studies have found an inverse association between nut intake and total mortality. Recently published in the British Journal of Nutrition, nut intake was associated with a lower risk of all-cause mortality in a large prospective study of 19,386 participants. As compared with subjects who did not eat nuts, those who consumed nuts more than 8 times per month showed a 47% lower risk of dying from any cause.¹

Similar results have been found in studies from populations around the world.² An analysis of studies for all-cause, cancer and cardiovascular disease (CVD) mortality, with a total of 354,933 participants, nut consumption was associated with significant protection. One-serving of nuts per day resulted in 27% lower risk from dying from any cause including CVD and cancer.³ In another systematic review and analysis of large, well-designed prospective population studies in Europe and North America showed that nut consumption is inversely associated with all-cause mortality, total CVD mortality, coronary heart disease mortality and sudden cardiac death. In Iran, in a large population study, researchers also found an inverse association of nut consumption with total and cause-specific mortality, after adjusting for potential confounders. Relative to those who did not eat nuts, women who ate three or more servings of nuts per week had a 51% lower risk of death, whereas men in this consumption category had 16% lower risk. Inverse associations were observed for most major causes of death, including cardiovascular disease, all cancers and gastrointestinal cancers.⁴

In another large study on nut consumption and mortality, published in the *New England Journal of Medicine*, the association of nut consumption with total and cause-specific mortality was examined among 76,464 women in the Nurses' Health Study and 42,498 men in the Health Professionals Follow-up Study. Consumption of nuts, such as pistachios, was inversely associated with total mortality in both men and women, independent of other predictors for mortality. Those who ate nuts (one ounce per day or more) seven days a week had a 20% lower death rate. Furthermore, consuming nuts was also associated with a lower risk of death due to cancer, heart disease and respiratory disease.⁵

Looking at the body of evidence from all these studies, researchers conclude that nut consumption may reduce the risk of coronary heart disease, stroke, cardiovascular disease, total cancer, and all-cause mortality, and possibly mortality from diabetes, respiratory disease, and infectious disease. In 2013, they estimated that 4.4 million deaths may be attributable to a nut intake below 20 grams per day in North and South America, Europe, Southeast Asia, and the Western Pacific.² These findings support dietary recommendations to increase nut consumption to reduce chronic disease risk and mortality.



¹ Bonaccio M. et al. Nut consumption is inversely associated with both cancer and total mortality in a Mediterranean population: prospective results from the Moli-sani study. *Br J Nutr* doi: 10.1017/S0007114515002378

² Aune D. et al. Nut consumption and risk of cardiovascular disease, total cancer, all-cause and cause-specific mortality: a systematic review and dose-response meta-analysis of prospective studies *BMC Medicine* doi.org/10.1186/s12916-016-0730-3

³ Grosso G. et al. Nut consumption on all-cause, cardiovascular, and cancer mortality risk: a systematic review and meta-analysis of epidemiologic studies. *Am J Clin Nutr* doi: 0.3945/ajcn.114.099515

⁴ Eslamrasti T. et al. Nut consumption and total and cause-specific mortality: results from the Golestan Cohort Study *Int J Epidemiol*. doi: 10.1093/ije/dyv365

⁵ Bao Y. et al. Association of Nut Consumption with Total and Cause-Specific Mortality. *N England J Med* 369L2001-11

Pistachios and Antioxidants



Pistachios are a source of a broad range of antioxidants such as gamma-tocopherol (a form of vitamin E), polyphenols and the carotenoids, lutein and zeaxanthin.¹ Antioxidants are substances that may protect your cells against the effects of free radicals, molecules that are produced as part of the body's normal metabolism, or by environmental contaminants like tobacco smoke, exhaust fumes and radiation. Free radicals can cause damage, known as "oxidative stress", and may play an important role in aging and diseases that come with age like heart disease, cancer and rheumatoid arthritis.² In addition, many of these antioxidants have strong anti-inflammatory activity. Low grade chronic inflammation has a role in aging. Studies show that eating pistachios increases levels of antioxidants in the blood and lower measures of oxidative stress.³

The phytochemical compounds found in the skin and kernels of pistachios have beneficial effects in our bodies. Researchers ground kernels and skins from unsalted, roasted pistachios and made either fat soluble or water soluble extracts with them. They then quantified phytochemicals in them and measured their bioactive activity in test tubes and using cell culture media they found unsaturated fatty acids, phytosterols (beta systosterol) and gamma tocopherol are major constituents of the fat soluble extract, of both the kernel and the skins. They prevent fat accumulation in fat cells. Polyphenols are dominant in the water soluble component and are particularly rich in the skins. They had an antioxidant activity and prevented the formation of pro-inflammatory compounds.⁴

A recent study isolated the phytochemical and bioactivity of pistachio hulls and revealed the presence of anacardic acids, fatty acids and phytosterols as major components. The chemical composition in the hulls exhibited antioxidant and anti-inflammatory properties.⁵ The study indicated pistachio hulls represents a rich source for value-added products with potential in food supplement and drug industries.

Eating pistachios may preserve skin health. Because of the antioxidant and anti-inflammatory roles played by carotenoids, flavonoids and tocopherols and in conjunction with their already characterized presence in human skin when consumed orally, these nutrients may play a role in the promotion of skin health and protection against photodamage.⁶

¹ Mandalari G, et al. Bioaccessibility of pistachio polyphenols, xanthophylls, and tocopherols during simulated human digestion. *Nutr.* 2013;29(1):338-44.

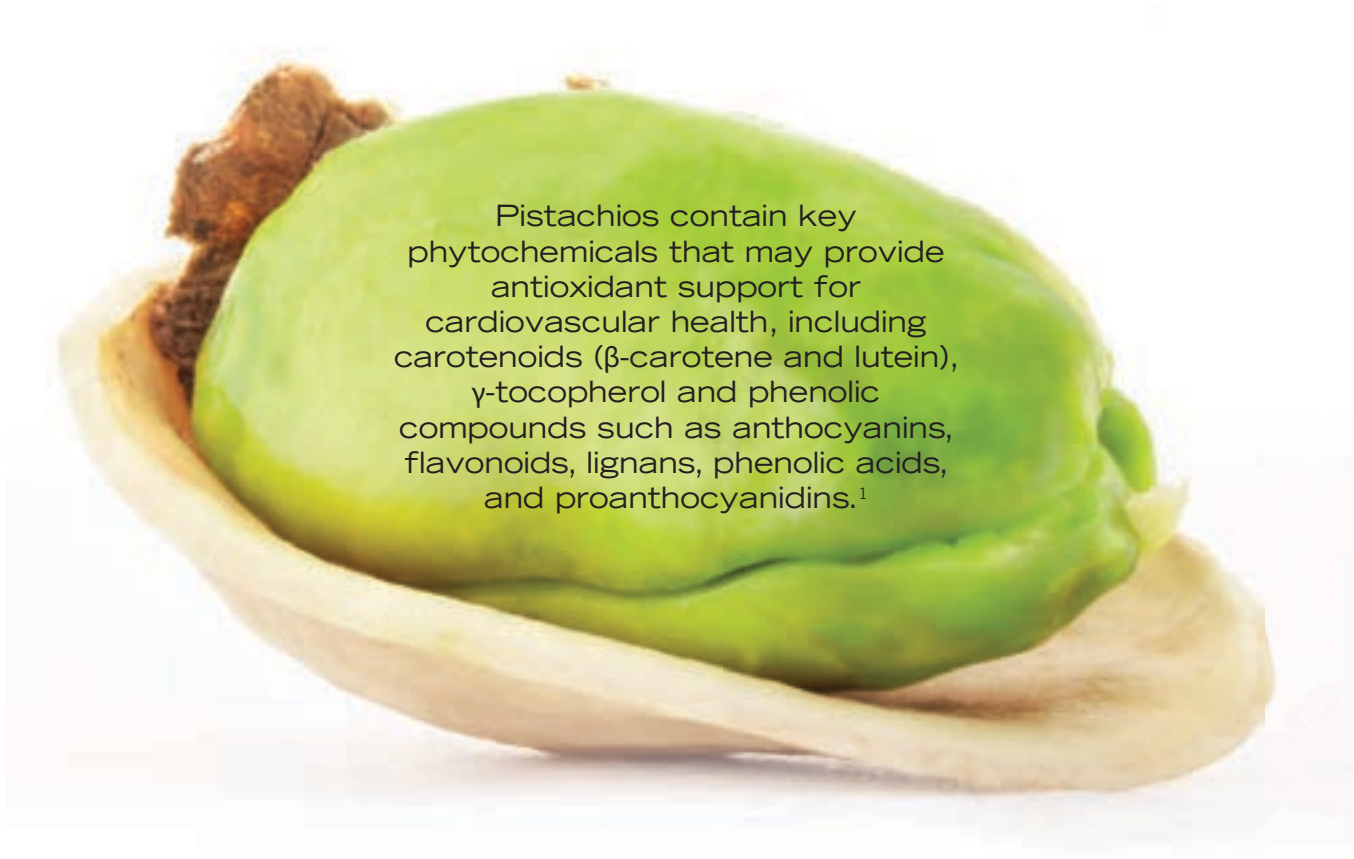
² Mayne, ST. Antioxidant nutrients and chronic disease: use of biomarkers of exposure and oxidative stress status in epidemiologic research. *J Nutr.* 2003 Mar; 133 Suppl 3:933S-940S

³ Kay, CD. Et al. Pistachios increase serum antioxidants and lower serum oxidized-LDL in hypercholesterolemic adults. *J nutr.* Doi: 10.3945/jn.109.117366

⁴ Grace MH, Esposito D, Timmers, M, Xiong J, Yousef G, Kornysky S, Lila MA, In vitro lipolytic, antioxidant and anti-inflammatory activities of roasted pistachio kernel and skin constituents, *Royal Soc of Chem*, 2016|DOI: 10.1039/c6o00867d

⁵ <http://dx.doi.org/10.1016/j.foodchem.2016.04.088>

⁶ C-Y. Oliver Chen, Avi Smith, Yuntao Liu, Peng Du, Jeffrey B. Blumberg & Jonathan Garlick (2017): Photoprotection by pistachio bioactives in a 3-dimensional human skin equivalent tissue model, *International Journal of Food Sciences and Nutrition*, DOI:10.1080/09637486.2017.1282437



Pistachios contain key phytochemicals that may provide antioxidant support for cardiovascular health, including carotenoids (β -carotene and lutein), γ -tocopherol and phenolic compounds such as anthocyanins, flavonoids, lignans, phenolic acids, and proanthocyanidins.¹

Research published in *The Journal of Nutrition* (June 2010) suggests eating pistachios raises the levels of serum antioxidants, such as lutein and gamma tocopherol, which may contribute to lower levels of oxidized-LDL cholesterol.² Higher amounts of oxidized-LDL and fat-breakdown products are found in atherosclerotic plaques. These substances are thought to play a role in the development and progression of atherosclerosis, the collection of fatty materials along the arteries. Lowering oxidized-LDL decreases the risk of heart disease. This study validates the significant antioxidant benefits of consuming pistachios. A second study published in *Nutrition* showed that pistachio polyphenols, xanthophylls and tocopherols are more than 90% bioaccessible during digestion.

These nutrients contribute to the beneficial relationship between pistachio consumption and health outcomes, such as heart disease.³

Ukhanova, et al. (2014) studied the effects of increased nut consumption as an effective means of modifying gut microbiota. The natural fibers and phytochemicals present in nuts provide substrates for the maintenance of healthy and diverse microbiota. The study analyzed fecal samples from participants after being fed different amounts of nuts for 18 days. The researchers concluded that the gut microbiota composition was positively affected by nut consumption, with a stronger affect with pistachio consumption in particular. That included an increase in the number of potentially beneficial butyrate-producing bacteria.⁴

¹ Bolling BW, et al. Tree nut phytochemicals: Composition, antioxidant capacity, bioactivity, impact 1 factors. A systematic review of almonds, Brazils, cashews, hazelnuts, macadamias, pecans, pine nuts, pistachios, and walnuts. *Nutr Res Rev.* 2011;24:244-275.

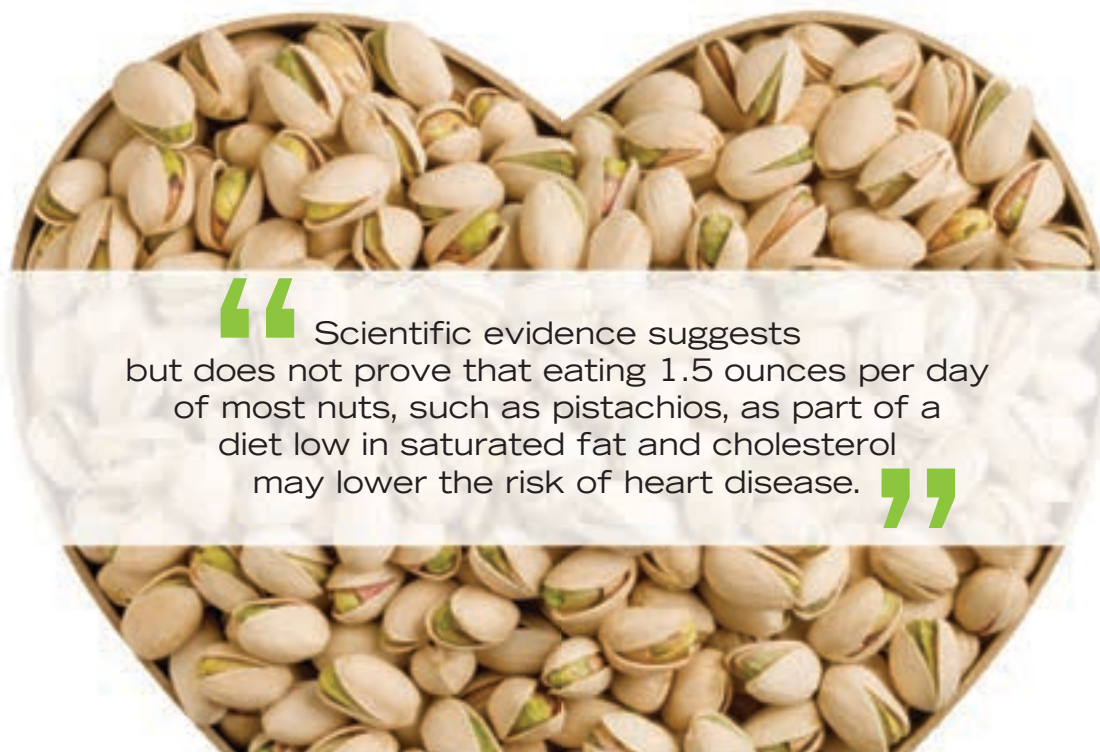
² Kay CD, et al. Pistachios increase serum antioxidants and lower serum oxidized-LDL in hypercholesterolemic adults. *J Nutr.* 2010;140:1093-1098.

³ Mandalari G, et al. Bioaccessibility of pistachio polyphenols, xanthophylls, and tocopherols during simulated human digestion. *Nutr.* 2013;29:338-344.

⁴ Ukhanova et al. Effects of almond and pistachio consumption on gut microbiota composition in a randomised cross-over human feeding study. *Br J of Nutr.* 2014;111, 2146-2152.

Pistachios and Heart Disease

Pistachios are one of the tree nuts included in the nut-qualified health claim approved by the FDA in July 2003, which stated:



“ Scientific evidence suggests but does not prove that eating 1.5 ounces per day of most nuts, such as pistachios, as part of a diet low in saturated fat and cholesterol may lower the risk of heart disease. ”

The 2015-2020 Dietary Guidelines for Americans¹ encourage consumers to choose nutrient-dense eating patterns to reduce the risk of chronic disease, including cardiovascular disease. These patterns are high in vegetables, fruit, whole grains, seafood, legumes, and nuts while being moderate in low- and non-fat dairy products; lower in red and processed meat; and low in sugar-sweetened foods and beverages and refined grains. A nutrient-dense food, pistachios can help consumers meet nutrient recommendations for fiber and potassium while limiting overconsumption of sodium and saturated fatty acids.

In February 2013, the landmark PREDIMED study published in the *New England Journal of Medicine* showed a Mediterranean diet supplemented with nuts, such as pistachios, significantly reduced cardiac events. In this clinical trial of about 7,400 subjects, those who ate a Mediterranean diet with either one ounce of nuts per day or one liter of olive oil per week had a 30% risk reduction in heart disease-related events. Importantly, this risk reduction is the same as for statins, which are cholesterol-lowering drugs.²

Pistachios likely reduce overall heart disease risk beyond just a decrease in total and LDL cholesterol alone. Numerous studies have looked at the effects of eating pistachios on many risk factors for cardiovascular disease.³⁻¹³

¹ <https://health.gov/dietaryguidelines/2015/guidelines/executive-summary/>

² Estruch R, et al. Primary prevention of cardiovascular disease with a Mediterranean diet. *New Engl J Med*. 2013 Apr 4;368(14):1279-1290.

³ Holligan S, et al. A moderate-fat diet with pistachios lowers small-dense LDL and improves markers of insulin sensitivity in subjects with moderately-elevated cholesterol levels. *FASEB J*. 2013;27: A5071, 1057.3

⁴ West SG, et al. Diets containing pistachios reduce systolic blood pressure and peripheral vascular responses to stress in adults with dyslipidemia. *Hypertension*. 2012;60(1):58-63.

⁵ Mohammadifard N, et al. The effect of tree nut, peanut, and soy nut consumption on blood pressure: a systemic review and meta-analysis of randomized controlled clinical trials. *The Am J of Clin Nutr*. 2015; 101(5):966-982.

⁶ Aldemir M, et al. Pistachio diet improves erectile function parameters and serum lipid profiles in patients with erectile dysfunction. *Internat J Impotence Res*. 2011;23:32-38.

⁷ Kay CD, et al. Pistachios increase serum antioxidants and lower serum oxidized-LDL in hypercholesterolemic adults. *J Nutr*. 2010;140:1093-1098.

⁸ Zhang J, et al. Effect of pistachio oil on gene expression of IFN-induced protein with tetratricopeptide repeats 2: A biomarker of inflammatory response. *Mol Nutr & Food Res*. 2010;54:1-10.

⁹ Sari I, et al. Effect of pistachio diet on lipid parameters, endothelial function, inflammation, and oxidative status: A prospective study. *Nutr*. 2010;26:399-404.

¹⁰ Gebauer SK, et al. Effects of pistachios on cardiovascular disease risk factors and potential mechanisms of action: A dose response study. *Am J Clin Nutr*. 2008;88:651-659.

¹¹ Sheridan MJ, et al. Pistachio nut consumption and serum lipid levels. *J Am Coll Nutr*. 2007;26(2):141-148.

¹² Kocyigit A, et al. Effects of pistachio nuts consumption on plasma lipid profile and oxidative status in healthy volunteers. *Nutr Metab Cardiovasc Dis*. 2006;16:202-209.

¹³ Edwards K, et al. Effect of pistachio nuts on serum lipid levels in patients with moderate hypercholesterolemia. *J Am Coll Nutr*. 1999;18:229-232.

These studies suggest eating pistachios daily (one to three ounces or as 10%–20% of calories) may reduce the risk of heart disease in five ways:

- 1) **Lowering total cholesterol, LDL cholesterol and non-HDL cholesterol;**
- 2) **Increasing antioxidants in the blood and decreasing oxidized-LDL;**
- 3) **Decreasing small dense LDL and increasing phytosterol levels in the blood;**
- 4) **Providing beneficial anti-inflammatory properties;**
- 5) **Reducing acute stress by lowering blood pressure, heart rate and peripheral vascular responses.**

(Pairing nuts and dried fruit for cardiometabolic health.) This review examined the potential of pairing the complementary set of nutrients found in nuts and dried fruit to lower cardiometabolic risk factors. Nuts, particularly pistachios, provide L-arginine, an amino acid that can help blood vessels relax and improve circulation. Nuts provide polyphenol antioxidants that inhibit the oxidative processes leading to atherosclerosis. Both nuts and dried fruit provide fiber, potassium, and magnesium that help lower risk of cardiovascular disease. Increasing consumption of both could help improve Americans nutritional status and reduce the risk of chronic diseases.²

(Effect of pistachio nut consumption on endothelial function and arterial stiffness.) In this study, 60 adults with dyslipidemia (elevated blood lipids) who ate 1.5 oz shelled pistachios for 3 months had a significant increase in high-density lipoprotein cholesterol (“good” cholesterol), a decrease in low-density lipoprotein cholesterol and improvements in vascular stiffness and endothelial function compared to those in a lifestyle modification group.³

(Other studies: Effect of pistachio consumption on plasma lipoprotein subclasses in pre-diabetic subjects.)

Hernández-Alonso P, Salas-Salvado J, Baldrich-Mora M, Mallol R, Correig X, Bulló M. Nutr Metab Cardiovasc Dis. 2015 Apr;25(4):396-402. doi: 10.1016/j.numecd.2015.01.013. Epub 2015 Feb 7

In a recent study, West, et al. (2012) found, in a randomized, controlled, cross-over feeding trial on 28 hypercholesterolemic subjects, that those consuming 10% of calories from pistachios had significant reductions in systolic blood pressure (mean change in systolic blood pressure, -4.8 vs -2.4 mm Hg, respectively; $P < 0.05$). At the 20% calorie level, there were significant reductions in peripheral resistance (-62.1 dyne·s·cm⁵) and heart rate (-3 bpm) versus the control diet ($P < 0.0001$). These reductions in peripheral vascular constriction and the resulting decrease in hemodynamic load may be important factors in lowering the risk of cardiovascular disease in pistachio consumers.⁴

The beneficial blood lipid effect of pistachios likely results from the unsaturated fatty acid content (of 13 g total fat; 4 g of PUFA and 7 g of MUFA with 1.5 g of SFA), the phytosterol content (122 mg per ounce), dietary fiber (3.4 g of fiber per ounce with .42 g being soluble), plant protein (6.2 g per ounce) and magnesium (31 mg per ounce).

A meta-analysis of randomized controlled clinical trials by Mohammadifard, et al. (2015) singled out pistachios among other nuts as having the strongest effect in reducing blood pressure. Subgroup analysis based on the type of nut consumed suggested that pistachios have the strongest effect in reducing both systolic and diastolic blood pressure in participants without diabetes.⁵



² Pairing nuts and dried fruit for cardiometabolic health. Carughi A, Feeney MJ, Kris-Etherton P, Fulgoni V 3rd, Kendall CW, Bulló M, Webb D. Nutr J. 2016 Mar 5;15:23. doi: 10.1186/s12937-016-0142-4.

³ Effect of pistachio nut consumption on endothelial function and arterial stiffness. Kasliwal RR, Bansal M, Mehrotra R, Yeptho KP, Trehan N. Nutrition. 2015 May;31(5):678-85. doi: 10.1016/j.nut.2014.10.019. Epub 2014 Nov 7.

⁴ West SG, et al. Diets containing pistachios reduce systolic blood pressure and peripheral vascular responses to stress in adults with dyslipidemia. Hypertension. 2012;60(1):58-63.

⁵ Mohammadifard N, et al. The effect of tree nut, peanut, and soy nut consumption on blood pressure: a systemic review and meta-analysis of randomized controlled clinical trials. The Am J of Clin Nutr. 2015; 101(5):966-982.

Published in 2010 in the *Archives of Internal Medicine*, a pooled analysis of 25 studies suggests eating nuts, such as pistachios, has a total and LDL (bad) cholesterol-lowering effect, further confirming the evidence that regular nut consumption can lower the risk of coronary heart disease. The analysis included 583 normo- and hypercholesterolemic men and women who were not on cholesterol-lowering medication. Those who consumed an average of 67 g (or 2.4 ounces) of nuts per day had a mean estimated reduction in total cholesterol, LDL-cholesterol, LDL/HDL ratio and total cholesterol/HDL ratio of 5.1%, 7.4%, 8.3% and 5.6%, respectively. The effect of nuts was dose-related, and different types of nuts had similar effects on blood lipids.¹⁴

Two other PREDIMED study papers, published in 2013 in the *Public Library of Science Online Journal and BioMed Central*, presented cross-sectional data from the beginning of the trial. Both assessed 7,216 subjects and the associations between the frequency and amount of nuts participants ate. Those subjects who ate more than three servings of nuts, including pistachios, per week had a 39% lower mortality risk. Notably, the researchers also found similar reductions for cancer and cardiovascular mortality risk. A second cross-sectional analysis showed those subjects who ate more than three servings of nuts, including pistachios, per week had a lower incidence of obesity, including abdominal obesity, metabolic syndrome and diabetes.^{15, 16}

A Life Sciences Research Organization report (2013) that examined the effects of nuts, including pistachios, on heart disease concluded that “Combining the results of the observational study analyses with the interventional study analyses meeting the FDA criteria, there is strong evidence that consumption of tree nuts has a beneficial effect on cardiovascular health and a real and practical effect in reducing the risk of CVD.” (P. 2)¹⁷



¹⁴ Sabate J, et al. Nut consumption and blood lipids: A pooled analysis of 25 intervention trials. *Arch Intern Med.* 2010;170(9):821-827.

¹⁵ Ibarrola-Jurado N, et al. Cross-sectional assessment of nut consumption and obesity, metabolic syndrome and other cardiometabolic risk factors: The PREDIMED study. *PLOS ONE.* February 2013;8(2):e57367.

¹⁶ Guasch-Ferré M, et al. Frequency of nut consumption and mortality risk in the PREDIMED nutrition intervention trial. *BMC Medicine.* 2013 Jul 16;11:164.

¹⁷ An Evidence-Based Analysis of the Relationship between Consumption of Tree Nuts and the Risk of Cardiovascular Disease, Life Sciences Research Organization, December 2013.

Pistachios and Cancer



In a large prospective study published online in the *British Journal of Cancer*, researchers looked at the association between nut consumption, such as pistachios, and risk of pancreatic cancer among 75,680 women in the Nurses' Health Study. These women had no previous history of cancer.

The researchers found that women who consumed a one-ounce serving of nuts, such as pistachios, two or more times per week had a significantly reduced risk of pancreatic cancer compared to those who rarely ate nuts. Importantly, those who ate the most nuts tended to weigh less.¹

¹ Wang W. et al. Nut consumption and prostate cancer risk and mortality *Br J Cancer* 2016; 00-1-4

Pistachios and Weight Management and a Healthy Diet



Results from several recent studies suggest that adults who consume nuts, such as pistachios, versus those who do not, may have lower body weight measures, obesity and a lower prevalence of health risks such as heart disease and metabolic syndrome.^{1 2 3} They also have better diets.^{4 5 6}

O'Neil, et al. found tree nut consumers had higher daily intakes of calories and nutrients of concern: fiber, potassium, magnesium, and healthy fats: monounsaturated fats and polyunsaturated fatty acids. They also had lower intakes of added sugars, saturated fats and sodium than nonconsumers. Tree nut consumers also had lower weight, BMI and waist circumference than nonconsumers. In addition, those who consumed tree nuts had lower systolic blood pressure and higher HDL cholesterol (the good kind).

Research on pistachios also suggest that pistachios may assist with weight management and may likely do so through increased satiety, satiety signals and lower metabolizable energy.^{7 8 9 10}

Li, et al. , in a randomized, parallel, isocaloric, reduced-calorie, weight loss study in overweight and obese subjects, used pistachios or pretzels as a portion-controlled snack (approximately 230 calories). Unsurprisingly, both groups lost weight during the 12-week study.¹¹ The participants in the study

who ate pistachios significantly improved their body mass index (-4.3% vs -2%) and triglycerides) in comparison to those who ate a refined carbohydrate snack.

Of concern is that pistachios are nutrient and energy dense, and consumption may lead to unwanted body weight gain but in fact, the opposite has been reported: When healthy college age women ate pistachios providing an additional 20% of energy, there was no effect on weight gain or change in body fat, blood lipids or blood pressure. There was no interference in the absorption of dietary iron or zinc. Nutrient intake was significantly improved with the consumption of pistachios.¹²

Kennedy-Hagen, et al. and Honselman, et al. found that in-shell pistachios have a unique effect on reducing caloric intake. In the first study, subjects—a convenience sample of faculty and staff at a Midwestern university (N=118)—were given two bowls, one with pistachios and the second in which to place the empty shells. When the bowl with empty shells was periodically emptied versus being left unemptied for the day, the subjects were more mindful of the amount they consumed, resulting in the consumption of significantly fewer calories.

In the second study, a convenience sample was asked to evaluate brands of pistachios as kernels and in-shell as well as feelings of fullness and satisfaction after self-selection of a portion of pistachios. Subjects offered in-shell pistachios consumed an average of 125 calories, whereas subjects offered shelled pistachios consumed an average of 211 calories, a difference of 86 calories.

Interestingly, fullness and satisfaction ratings were not significantly different. The time to shell the pistachios and the additional volume noted when consuming in-shell pistachios appeared to result in subjects consuming about 40% fewer calories compared to pistachio kernels.

In a recent mixed nut study, a PREDIMED cross-sectional analysis on 7,216 subjects from the beginning of the trial showed those subjects who ate more than three servings of nuts, including pistachios, per week had a lower incidence of obesity, including abdominal obesity, metabolic syndrome and diabetes.¹³

Similarly Flores-Mateo, et al. reported in the *American Journal of Clinical Nutrition* the results of a review and analysis of 33 clinical nut-feeding studies that compared a control diet to a diet containing nuts and weight outcomes. The researchers found that nuts, including pistachios, did not increase body weight, waist circumference or body mass index.¹⁴

In a review of published tree nut research, Vadivel, et al. (2012) reported evidence that points to the prevention of obesity and other health benefits with consumption of tree nuts, including pistachios.¹⁵ This review reaffirms that eating nuts in moderate amounts does not increase body weight. Also, because of their energy density, protein and high-fiber content, tree nuts are satisfying, which the authors suggested may reduce overeating. The review indicated that frequent nut consumption may lower the risk of obesity in healthy subjects. The authors also concluded that the inclusion of tree nuts, such as pistachios, in amounts of 30–50 grams per day is advisable to ensure the many health benefits that their nutrient content provide.



¹ Bes-Rastrollo M, et al. Prospective study of nut consumption, long-term weight change, and obesity risk in women. *Am J Clin Nutr*. 2009;89:1–7.

² O'Neil CE, et al. Nut consumption is associated with decreased health risk factors for cardiovascular disease and metabolic syndrome in U.S. adults: NHANES 1999–2004. *J Am Coll Nutr*. 2011;30(6):502–510.

³ Estruch R, et al. Effect of a high-fat Mediterranean diet on bodyweight and waist circumference: a pre-specified secondary outcomes analysis of the PREDIMED randomized controlled trial. *Lancet Diabetes Endocrinol*. 2016 doi: 10.1016/S2213-8587(16)30085-7

⁴ O'Neil CE. Tree nut consumption is associated with better nutrient adequacy and diet quality in adults: National Health and Nutrition Examination Survey 2005–2010. *Nutrients* 2015 doi: 10.3390/nu7010595

⁵ O'Neil CE, et al. Out-of-hand nut consumption is associated with improved nutrient intake and health risk markers in US children and adults: National Health and Nutrition Examination Survey 1999–2004. *Nutr Res*. 2012;32:185–194.

⁶ Brown RC. Nut consumption is associated with better nutrient intakes: results from the 2008/09 New Zealand Adult Nutrition Survey. *Br J Nutr* 2016 doi: 10.1017/S0007114515004122

⁷ Wang X, et al. Effects of pistachios on body weight in Chinese subjects with metabolic syndrome. *Nutr J*. 2012;11(1):20.

⁸ Baer DJ, et al. Measured energy value of pistachios in the human diet. *British J Nutr*. 2012;107:120–125.

⁹ Kennedy-Hagan KJ, et al. The effect of pistachio shells as a visual cue in reducing caloric consumption. *Appetite*. 2011;57:418–420

¹⁰ Honselman CS, et al. In-shell pistachio nuts reduce caloric intake compared to shelled nuts. *Appetite*. 2011;57:414–417.

¹¹ Li Z, et al. Pistachio nuts reduce triglycerides and body weight by comparison to refined carbohydrate snack in obese subjects on a 12-week weight loss program. *J Am Coll Nutr*. 2010;29(3):198–203.

¹² Burns-Whitmore B, Bushnell AH, Towne AH, Roy S, Hall LM, Food Nutri J: 2017

¹³ Ibarrola-Jurado N, et al. Cross-sectional assessment of nut consumption and obesity, metabolic syndrome and other cardiometabolic risk factors: The PREDIMED study. *PLOS ONE*. 2013;8(2):e57367.

¹⁴ Flores-Mateo G, et al. Nut intake and adiposity: Meta-analysis of clinical trials. *Am J Clin Nutr*. 2013;97:1346–1355.

¹⁵ Vadivel V, et al. Health benefits of nut consumption with special reference to body weight control. *Nutr*. 2012;28:1089–1097

Pistachios have fewer calories than originally thought.

Baer, et al. (2012), in a controlled diet, cross-over feeding trial on 16 healthy subjects for 3 weeks, examined 3 levels of pistachio consumption for the amount of metabolizable energy and effects on blood lipids. The amount of pistachios given was 0 g, 42 g and 84 g/day. Urine, feces and diet were analyzed for fat, nitrogen, total dietary fiber and combustible energy. Energy value of pistachio kernels was calculated from differences in energy excretion for each dietary treatment. The researchers found the measured energy density of pistachios was 5% less than the currently accepted energy value using the Atwater general factors. Additionally, the pistachio nut intervention lowered LDL cholesterol by 6%.

In a recent mixed nut study, a PREDIMED cross-sectional analysis on 7,216 subjects from the beginning of the trial showed those subjects who ate more than three servings of nuts, including pistachios, per week had a lower incidence of obesity, including abdominal obesity, metabolic syndrome and diabetes.¹⁰

In June 2013, Flores-Mateo, et al. reported in the *American Journal of Clinical Nutrition* the results of a meta-analysis of 33 clinical nut-feeding studies that compared a control diet to a diet containing nuts and weight outcomes. The researchers found that nuts, including pistachios, did not increase body weight, waist circumference or body mass index.¹¹

In a review of published tree nut research, Vadivel, et al. (2012) reported evidence that points to the prevention of obesity and other health benefits with consumption of tree nuts, including pistachios. This review reaffirms that whereas nuts are nutrient and energy dense, the research does not support that increased consumption may lead to unwanted body weight gain. In fact, the opposite was found: that eating nuts in moderate amounts does not increase body weight. Also, because of their energy density, protein and high-fiber content, tree nuts are satisfying, which the authors suggested may reduce overeating. The review indicated that frequent nut consumption may lower the risk of obesity in healthy subjects. The authors also concluded that the inclusion of tree nuts, such as pistachios, in amounts of 30–50 grams per day is advisable to ensure various health benefits, including reducing the risk of heart disease and antioxidant effects.¹²



¹⁰ Ibarrola-Jurado N, et al. Cross-sectional assessment of nut consumption and obesity, metabolic syndrome and other cardiometabolic risk factors: The PREDIMED study. *PLOS ONE*. 2013;8(2):e57367.

¹¹ Flores-Mateo G, et al. Nut intake and adiposity: Meta-analysis of clinical trials. *Am J Clin Nutr*. 2013;97:1346–1355.

¹² Vadivel V, et al. Health benefits of nut consumption with special reference to body weight control. *Nutr*. 2012;28:1089-1097.

Pistachios, Blood Glucose, Diabetes and Insulin Sensitivity

Since the 2003 FDA-approved health claim for nuts and heart disease, there has been an increase in the number of studies showing the potential benefits of tree nut consumption, including pistachios, on blood glucose, diabetes, metabolic syndrome and insulin sensitivity. Two acute studies suggest that pistachios attenuate the rise in blood glucose after a meal when combined with high carbohydrate foods, both in healthy persons and in those with metabolic syndrome.^{1,2}



¹ Kendall CWC, et al. The impact of pistachio intake alone or in combination with high-carbohydrate foods on post-prandial glycemia. *Eur J Clin Nutr*. 2011;65(6):696-702.

² Kendall CWC, et al. Acute effects of pistachio consumption on glucose and insulin, satiety hormones and endothelial function in the metabolic syndrome. *Eur J Clin Nutr*. 2014;Mar;68(3):370-375.



Pistachios: Cardiometabolic Effects Including Blood Glucose, Diabetes and Insulin Sensitivity.

Diabetes (T2D) is one of the most common diseases worldwide and a recognized risk factor for cardiovascular disease and other chronic conditions. Research both from population studies and clinical studies suggest that nut consumption, including pistachios, may protect against T2D and benefit people with the disorder. Nutritionists attribute this protective effect to the fiber, healthy fats, antioxidants and anti-inflammatory compounds in nuts. Pistachios among all nuts have a low glycemic index, making them an effective candidate to attenuate the rise in blood sugar levels after a meal potentially decreasing the risk of diabetes.¹

Two studies measured just this, both in healthy persons and in those with metabolic syndrome. In the first study, researchers examined the effects of pistachio consumption on postprandial glucose levels.² Pistachios, when fed alone to healthy subjects, had little effect on blood sugar levels. Pistachios, when fed with a carbohydrate-rich meal, lowered the blood glucose response in a dose-dependent manner, e.g., the higher the dose of pistachios, the more the blood glucose level was lowered or attenuated. Pistachios, added to different common carbohydrate foods, such as rice and pasta, significantly reduced the relative blood glucose response of the carbohydrate meals with which they were eaten.

In a second study conducted in people with metabolic syndrome, researchers found similar results.³ They examined the effect of pistachios on postprandial glucose and insulin levels compared to five study meals that varied in the amount and type of fat, but were matched according to available carbohydrates. Within each group of available carbohydrate meals, postprandial glucose levels were the highest following the white bread-only meal and attenuated when pistachios were consumed. Researchers concluded that pistachios may have insulin-sparing properties, which could be beneficial for individuals with diabetes and metabolic syndrome.

In a landmark clinical study conducted in Spain researchers found that pistachio consumption helped people with pre-diabetes improve their condition.⁴ Before people get type 2 diabetes, they almost always have prediabetes—blood glucose levels that are higher than normal but not high enough to be diabetes. Prediabetes affects more than 86 million U.S. adults. Without treatment, 15 to 30 percent of people with prediabetes will get diabetes within 5 years.

The researchers wanted to find out how regularly eating pistachio nuts as part of a healthy diet might improve the ways that glucose and insulin are processed in people with prediabetes. Participants were divided into two groups. One group followed a diet that included 2 ounces of pistachio nuts per day for 4 months, and the other group followed a similar diet without pistachio nuts. All participants then ate a normal diet for another 2 weeks. Finally, for another 4-month period, the two groups crossed over, eating the opposite diet from the one they had followed during the first 4-month period. Glucose and insulin levels and other signs of insulin resistance were lower after participants followed the diet with pistachio nuts than after they followed the diet without nuts. Several other measures linked to diabetes and heart disease risk also improved after the pistachio nut diet. In addition, participants had higher levels of glucagon-like peptide1, a hormone that helps to control glucose levels, after following the diet with pistachio nuts. More over, pistachio intake modified lipoprotein particle size and subclass concentrations independently of changes in total plasma lipid profile, which may explain the lower risk in CVD and mortality associated with those individuals that frequently consume nuts.⁵ Finally, pistachios seemed to modulate novel markers of glucose metabolism (microRNAs) towards a pattern seen in healthy individuals.⁶

In a similar study, Parham et al evaluated the effectiveness of pistachio nut supplementation on glycemic and inflammatory measures in patients with T2D.⁷ They concluded that consumption of pistachio nuts as a snack has beneficial effects on glycemic control, blood pressure, obesity, and inflammation markers in these patients.

Gulati, et al. in a 24-week, randomized, controlled trial of 60 Asian Indians with metabolic syndrome, examined the effects of 20% of calories from pistachios, as part of a diet that met the Asian Indian dietary guidelines, on their cardiometabolic profile.⁸ The pistachio intervention group compared to the control group had significantly improved fasting blood glucose, total cholesterol, LDL cholesterol, waist circumference, and hs-CRP. Researchers concluded that a diet containing pistachios may improve the cardiometabolic profile of those with metabolic syndrome.

Recently, three additional mixed nut studies that included pistachios have been conducted on individuals with diabetes or metabolic syndrome. The results from the largest randomized clinical trial to date on nuts and diabetes showed a significant reduction in HbA1c, a long-term marker of blood sugar control, and a significant reduction in LDL cholesterol. This three-month parallel design study was conducted on non-insulin-dependent adults with diabetes who were treated with oral hypoglycemic medications. The subjects were randomized to one of three diets for 12 weeks. All diets included a supplement of 475 kcal per 2,000-kcal diet and met American Diabetes Association and National Cholesterol Education

Program Step II recommendations. The first diet included 75 g of mixed nuts (including pistachios); the second diet included 38 g of mixed nuts and a half portion of muffins; and the third diet contained a full portion of muffins. Those subjects receiving 75 g of mixed nuts had significantly reduced LDL and total cholesterol levels compared to the full dose muffin group, and a significant reduction in HbA1c compared to the other two diets.

The results of a large epidemiologic cohort study at Harvard suggested that frequent tree nut and peanut butter consumption (five times per week) is associated with a significantly lower cardiovascular disease risk in women with type 2 diabetes. Tree nut and peanut butter consumption is also associated with a better lipid profile, including a lower LDL cholesterol and total cholesterol concentrations.

Jaceldo-Siegel, et al., examined tree nut consumption and risk of metabolic syndrome.⁹ They found that high tree nut consumption was associated with a lower occurrence of metabolic syndrome and obesity. The risk for metabolic syndrome was significantly less, by 7%, if at least one ounce of tree nuts per week was consumed. Those who were high tree nut consumers also had a significantly lower prevalence of obesity compared to the low tree nut consumers.

Afshin, et al. studied the association of tree nuts including pistachios with major cardiometabolic endpoints. In the pooled analysis, they concluded that four weekly servings of one ounce of nuts were associated with a 24 percent lower risk of fatal ischemic heart disease (IHD) and a 22 percent lower risk of non-fatal IHD. There was also a 13% lower risk associated with diabetes at four servings per week.

¹ Bulló M, Juanola-Falgarona M, Hernández-Alonso P, Salas-Salvadó J.

Nutrition attributes and health effects of pistachio nuts *Br J Nutr.* 2015 Apr;113 Suppl 2:S79-93. doi: 10.1017/S0007114514003250

² Kendall CWC, et al. The impact of pistachio intake alone or in combination with high-carbohydrate foods on post-prandial glycemia. *Eur J Clin Nutr.* 2011;65(6):696-702.

³ Kendall CW, et al. Acute effects of pistachio consumption on glucose and insulin, satiety hormones and endothelial function in the metabolic syndrome. *Eur J Clin Nutr.* 2014 doi: 10.1038/ejcn.2013.275

⁴ Hernandez-Alonso, Beneficial effect of pistachio consumption on glucose metabolism, insulin resistance, inflammation, and related metabolic risk markers: a randomized clinical trial. *Diabetes Care* doi: 10.2337/dc14-1431

⁵ Hernandez-Alonso, P. Effect of pistachio consumption on plasma lipoprotein subclasses in pre-diabetic subjects. *Nutr Met Cardiovasc Dis.* 2015 doi: 10.1016/j.numecd.2015.01.013

⁶ Hernández-Alonso, P, et al. Chronic pistachio intake modulates circulating microRNAs related to glucose metabolism and insulin resistance in prediabetic subjects. *European J of Nutr.* 2016 doi: 10.1007/s00394-016-1262-5

⁷ Parham, M et al. Effect of pistachio nut supplementation on blood glucose in patients with type 2 diabetes: A randomized crossover trial. *Review Diabetic Studies.* 2014 doi: 10.1900/RDS.2014.11.190

⁸ Gulati, S. Effects of pistachio nuts on body composition, metabolic, inflammatory and oxidative stress parameters in Asian Indians with metabolic syndrome: a 24-wk, randomized control trial. *Nutrition* doi: 10.1016/j.nut.2013.08.005

⁹ Jaceldo-Siegl K, et al. Tree nuts are inversely associated with metabolic syndrome and obesity: the Adventist health study-2. *PLoS One* 2014 Jan 8;9(1):e85133. doi:0.1371/journal.pone.0085133

Pistachios may help women with gestational diabetes manage their blood sugar

Results of a study among pregnant women with impaired glucose tolerance or diagnosed with gestational diabetes show that eating 1-1/2 servings of pistachios resulted in a significantly lower rise in blood sugar and insulin levels than when they ate an equivalent snack of whole wheat bread matched for calories. The study is the first to evaluate the role of pistachios in pregnant women with gestational diabetes.^{1 2}

In the study, 30 women with gestational diabetes (all between 24 – 28 gestational weeks) were randomly assigned to eat a breakfast of either 42 grams of pistachios (about 1/3 of a cup, or 1 1/2 servings) or 100 grams of whole wheat bread (two slices) after an overnight fast. The pistachios and whole wheat bread were matched for calories. Blood sugar and GLP-1, a key insulin-producing hormone³, were measured every 30 minutes after the meal, up to 120 minutes. After seven days, the groups switched.

Blood sugar levels were significantly lower after consuming pistachios than they were after consuming whole wheat bread after 30 minutes, 60 minutes, 90 minutes and 120 minutes. In fact, blood sugar levels after eating pistachios were comparable to baseline levels. In addition, GLP-1 levels were significantly higher after consumption of pistachios compared to whole wheat bread after 60 minutes, 90 minutes, and 120 minutes.

The effect on insulin levels was even more dramatic. Blood insulin levels did not change during the two hours after eating the pistachios. Again, both groups of women had a significantly lower rise in blood insulin levels at every time point measured after eating the pistachios than they did after eating whole wheat bread.

¹ Ge, S. Effects of Pistachio Intake on Postprandial Blood Glucose Response in Pregnant Women. Presented at: The 10th Oriental Congress of Endocrinology and Diabetes (OCED 2017) from April 21-22, 2017 in Shanghai; The 13th China Nutrition Science Congress from May 22-24, 2017 in China National Convention Center in Beijing.

² Li, Z. The effect of pistachios on postprandial glucose in pregnant women with impaired glucose tolerance. Presented at: The Academy of Nutrition and Dietetics, Food and Nutrition Expo, October 23, 2017 in Chicago, IL.

³ http://care.diabetesjournals.org/content/34/Supplement_2/S279



Pistachios for an Active Life

Diet plays a large role in men's and women's health.

Adding nutrient-rich foods like pistachios to the diet can give a nutritional boost.

Pistachios have a wealth of nutrients that are important for overall health, including phytosterols, antioxidants, healthy fats, fiber, protein and potassium. Nutrition experts nationwide recommend pistachios as a satisfying snack that can benefit men and women of all ages.



Protein & Exercise

A primary concern for men is maintaining lean body tissue and muscle tone over the years. This requires a workout routine that includes both strength training and cardiovascular exercise. Additionally, a healthy diet can support the processes that happen within muscle tissue after exercise to promote muscle growth and prevent fatigue.

Research has shown that eating protein is beneficial for muscle recovery when consumed after intense exercise.⁷ With 6 grams of protein per serving, pistachios make an ideal post exercise snack. The Academy of Nutrition and Dietetics suggests refueling with a mix of protein and carbohydrates 15 to 20 minutes post exercise for optimal muscle repair and recovery and to replenish muscle glycogen stores.⁸ One ounce of pistachios, along with a serving of fruit, makes a great snack after a particularly strenuous workout.



⁷ Lewis PB et al., *Clin Sports Med* 2012;31:255-262

⁸ Mohr CR. *Timing Your Nutrition*. Academy of Nutrition and Dietetics (2012). <http://www.eatright.org/Public/content.aspx?id=6442463964>

American pistachios are a powerhouse of important vitamins, minerals and nutrients that help support active lifestyles.



The ideal post exercise snack is portable, satisfying and supplies the body with the energy and important nutrients it needs to refuel after exercise. Read on to find out how pistachios can help to meet the post exercise needs of casual fitness enthusiasts and athletes.

Physical activity is an essential component of a healthy lifestyle but can sometimes lead to exercise-induced muscle damage and sore muscles from oxidative stress and inflammation. This can lead to a decline in muscle activity and delayed recovery. While further studies are needed to confirm the results, emerging evidence suggests that antioxidants may help with muscle recovery.¹ Pistachios are a natural source of the antioxidants lutein, β -carotene and γ -tocopherol, and laboratory studies suggest that pistachios have a strong antioxidant capacity.²

¹ Sousa M, et al. *Int J Food Science Nutr.* 2014; 65(2):151-163.

² O'Neil CE, et al. *Out-of-hand nut consumption is associated with improved nutrient intake and health risk markers in US children and adults: National Health and Nutrition Examination Survey 1999-2004. Nutr Res.* 2012;32:185-194.



Pistachios and Aging

While muscle mass loss is inevitable with aging, adequate protein intake and a balanced diet and exercise are vital to manage or prevent sarcopenia, a condition in which loss of muscle mass is associated with a decline in muscle function and strength leading to falls and fractures.¹ Studies show that around age 50 we lose about 1 to 2% muscle mass per year. This becomes more significant in the early 60s when the loss may begin to affect physical ability as muscle strength declines at an average rate of 3 percent per year after 60, and by the 70s and estimated 20 to 40 percent of muscle strength is lost.² Protein intake and physical activity are the main stimuli for muscle protein synthesis. Increasing protein intake may help maintain muscle strength and prevent loss of physical ability among the elderly.³

Pistachios deliver 6 grams of protein or 12% of an adult's daily requirement.

A concern in men is maintaining lean body tissue and muscle tone over the years. This requires a work out routine that includes both strength training and exercise that raises one's heart rate. Eating the right foods is important to support the processes that happen within muscle tissue during and after exercise and prevent fatigue. Pistachios make a great snack to help maintain peak energy throughout the day after a workout. They provide the right combination of energy and protein to prevent fatigue and support muscle repair and recovery.

- Pistachios make a great snack because they provide the right combination of energy and protein (over 10% of an adult's daily requirement) to maintain muscle strength and physical fitness.
- Provide right type of plant base protein that helps preserve muscle mass and function.
- Each serving of pistachios has 6 grams of protein or 12% your daily value. Protein is important for repairing and renewing tissues in the body and for building and maintaining muscle mass. Protein also keeps you feeling full longer and so helps you resist the temptation for extra snacks and sugar.

While more research is needed to confirm the results, emerging research suggests that eating pistachios may improve circulation to penile tissues and so improve sexual performance in men suffering from erectile dysfunction.⁴



⁴ Aldemir M, Okulu E, Neselioglu S. Et al. Pistachio diet improves erectile function parameters and serum lipid profiles in patients with erectile dysfunction. *Intern J Impot Res* (2011); 1-7

The Love Nut

Known as the 'love nut', Pistachios are packed with nutrients essential for a healthy sex life! This powerful nut contains B vitamins and Vitamin E, which have been proven to help with erectile dysfunction. They are also rich in potassium, calcium, magnesium and phosphorus – great for a healthy heart.ⁱ

As well as being a key ingredient for your love life this Valentine's Day, pistachios are great for weight management and helping you to banish those 'love handles.' A one ounce serving of pistachios is 49 nuts—this is more per serving than any other nut making them ideal for healthy snacking.ⁱⁱ

Diet Quality

As one ages, there is a need to maximize nutrient content per calories consumed. Snacking on pistachios is good for you. It boosts energy, provides key nutrients, helps control hunger and reduces bingeing. They make a difference in the quality of a diet: they are nutrient dense and help you keep healthy and maintaining physical vitality.

One serving of pistachios has about 20% of the daily requirement of vitamin B6, as well as 20% of that for copper and manganese. It is also rich in thiamin (vitamin B1), phosphorus, magnesium and potassium. And the benefits show: studies report that eating nuts like pistachios improves the nutrient content and quality of the diet.

¹ Rizzoli L. Nutrition and Sarcopenia. *J Clin Densitom.* 2015 Oct-Dec;18(4): 483-7.

² Sahni S. et al. Higher Protein Intake is Associated with Higher Lean Mass and Quadriceps Muscle Strength in Adult Men and Women. *J Nutr.* 2015 Jul; 145(7): 1569-1575.

³ McLean R, Mangano KM, Hannan MT, Kiel DP, Sahni S. Dietary Protein Intake is Protective Against Loss of Grip Strength Among Older Adults in the Framingham Offspring Cohort. *J Gerontol A Biol Sci Med Sci.* 2016 Mar;71(3): 356-61.

ⁱ *International Journal of Impotence Research*, Aldemir M, Okulu E, Neşelioglu S, Erel O, Kaygılı O, 2011. Pistachio diet improves erectile function parameters and serum lipid profiles in patients with erectile dysfunction. *Int J Impot Res.* 23(1):32-8.

ⁱⁱ Honselman CS, Painter JE, Kennedy-Hagan KJ, Halvorson A, Rhodes K, Brooks TL, Skwir K. 2011. In-shell pistachio nuts reduce caloric intake compared to shelled nuts. *Appetite.* Oct;57(2):414-7

American Pistachios – a Powerhouse of Nutrients



Pistachios offer far more than just calories and protein for active people. They also have hard-to-get nutrients like magnesium and vitamin A, and other phytochemicals. Pistachios are also a good source of copper and manganese. In fact, research shows that pistachio eaters tend to have a diet with overall higher nutrient quality.² Additionally, in a randomized crossover controlled feeding study, Kay, et al. (2010) found that people eating pistachios had greater levels of plasma lutein and g-tocopherol.⁵

The body loses potassium with sweat during intense exercise. Potassium is a major electrolyte that plays an important role in normal body functions, such as nerve function and muscle control. When potassium is lost during exercise it can lead to muscle weakness.⁶ Include potassium-containing foods along with water to help replenish this important mineral after exercise.⁴ Pistachio nuts are a source of potassium, and a one-ounce serving of pistachios actually has as much potassium as half of a large banana.

The correct serving size of pistachios is one ounce, or about 49 kernels — more nuts per serving than any other nut! While these green kernels are a calorie-dense food, research suggests that pistachio eaters do not weigh more than people who avoid pistachios.⁷ Not only do pistachios take longer to crack open; they are also satiating, which keeps you feeling fuller longer.



² O'Neil CE, et al. Out-of-hand nut consumption is associated with improved nutrient intake and health risk markers in US children and adults: National Health and Nutrition Examination Survey 1999-2004. *Nutr Res.* 2012;32:185-194.

⁴ Mohr CR. Timing Your Nutrition. *Academy of Nutrition and Dietetics* (2012). <http://www.eatright.org/Public/content.aspx?id=6442463964>

⁵ Kay CD, et al., *Journal of Nutrition.* 2010;140:1093-1098

⁶ <http://www.acefitness.org/certifiednewsarticle/715/electrolytes-understanding-replacement-options/>

⁷ Flores-Mateo G, et al. *Am J Clin Nutr.* 2013;97:1346-1355



B Vitamins

Pistachios are also a good source of vitamins that play a key role in energy metabolism. A one-ounce serving of pistachio provides over 15% of the Daily Value of thiamin (B1) and pyridoxine (B6). Together, these vitamins are involved in most energy-producing reactions in the body, in the metabolism of branched chain amino acids and in more than 60 reactions related to protein synthesis (the process needed to build protein within the body).

Fats & Fiber

Pistachios contain mostly mono- and polyunsaturated fats (those that are recommended for a healthy heart and circulation) and over 10% the Daily Value of fiber. They are also a source of the amino acid arginine, which can enhance blood flow by boosting nitric oxide, a compound that relaxes blood vessels. These heart-protective properties of pistachios prompted scientists from the Ataturk Teaching and Research Hospital, Turkey, to investigate the effect of a pistachio diet on erectile function.



Erectile dysfunction (ED) can accompany heart disease or vascular problems because relaxation of blood vessels (the processes required to sustain an erection) can become impaired. To find out if pistachios could help men suffering from chronic erectile dysfunction, researchers added 3.5 ounces of pistachios (100 grams) each day to the diet of 17 married male patients. After 3 weeks, the men showed marked improvements in a number of measures of erectile function including sexual intercourse satisfaction, orgasmic function, sexual arousal and overall satisfaction. In addition, blood flow in the penis increased 22%.⁴

Phytosterols

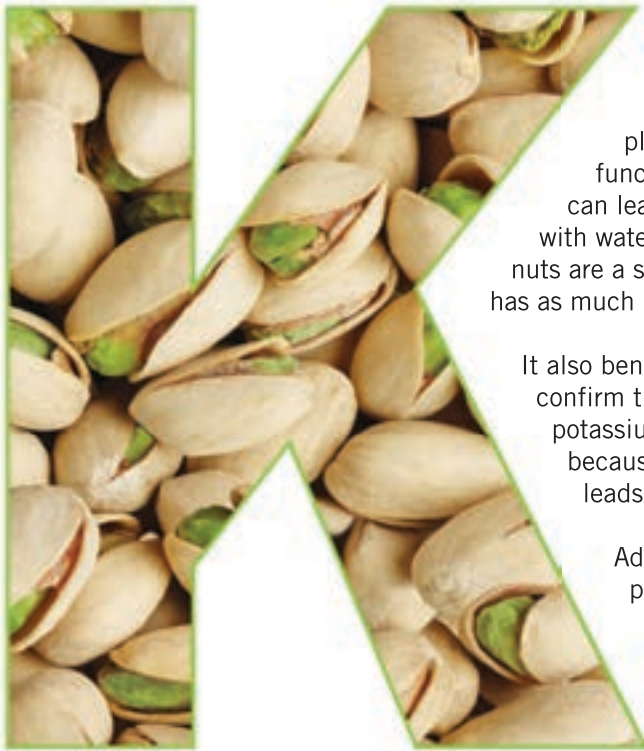
Phytosterols are plant-derived substances that have been shown to lower blood cholesterol levels by interfering with the absorption of cholesterol from other foods. Early human diets were rich in phytosterols, but today's typical diet is quite low by comparison. Pistachios have the highest levels of beta-sitosterol - a type of phytosterol - among nuts, and research suggests that eating pistachios may help to raise levels of beta-sitosterol in the blood.⁵ Some clinical trials also suggest that phytosterols may help maintain normal prostate health.⁶



⁴ Aldemir M, Okulu E, Neselioglu S. *Et al.* Pistachio diet improves erectile function parameters and serum lipid profiles in patients with erectile dysfunction. *Intern J Impotence Res* (2011); 1-7

⁵ Holligan S, Gebauer SK, West SG. *Et al.* Dose-related effects of pistachios on plasma sterol concentrations in moderately hypercholesterolemic individuals. Presented at the Experimental Biology Meeting (2011)

⁶ Witt TJ, MacDonald R, Ishani A. Beta-sitosterol for the treatment of benign prostatic hyperplasia: A systematic review. *BJU Int.* (1999); 83(9):976-983



Potassium

Finally, pistachios are a source of potassium, a nutrient that is low in the diet of most men.⁹ Potassium is a major electrolyte that plays an important role in normal body functions, such as nerve function and muscle control. When potassium is lost during exercise it can lead to muscle weakness.¹⁰ Include potassium-containing foods along with water to help replenish this important mineral post exercise.¹⁰ Pistachio nuts are a source of potassium, and a one-ounce serving of pistachios actually has as much potassium as half of a large banana.

It also benefits muscle in another way: while further studies are needed to confirm the results, initial research suggests that eating foods rich in potassium may help preserve muscle in older adults.¹¹ This is important because muscle mass gradually declines after age 50, and muscle loss leads to muscle weakness, which can affect quality of life.

Additionally, it is now recognized that including natural sources of potassium in the diet is important in controlling blood pressure because it lessens the negative effect of sodium on blood pressure. Including pistachios as part of a healthy diet may support blood pressure health, either by increasing overall potassium content of the diet or by a mechanism yet to be discovered. A study conducted at the Penn State found that substituting 3 ounces or 1.5 ounces of pistachios for other foods in the diet may help to lower the body's blood pressure response to everyday stress.¹¹

Food is more than just fuel. Eating right can help men to feel good while improving their health. Small gradual changes towards healthy eating can make a big difference. So rather than reaching for a bag of pretzels, choose pistachios instead!



⁹ Cogswell ME, et al. Sodium and potassium intakes among US adults: NHANES 2003-2008. *Am J Clin Nutr*, (2012); 96(3): 647-657.

¹⁰ <http://www.acefitness.org/certifiednewsarticle/715/electrolytes-understanding-replacement-options/>

¹¹ West SG, Gebauer SK, Kay CD, Bagshaw DM, Savastano DM, Diefenbach C, Kris-Etherton P. Diets Containing Pistachios Reduce Systolic Blood Pressure and Peripheral Vascular Responses to Stress in Adults with Dyslipidemia. *Hypertension*. 2012 Jun 4.

FACT SHEET

NUTRITION FACTS

SERVING SIZE

1 OZ. (28.35 G) OR

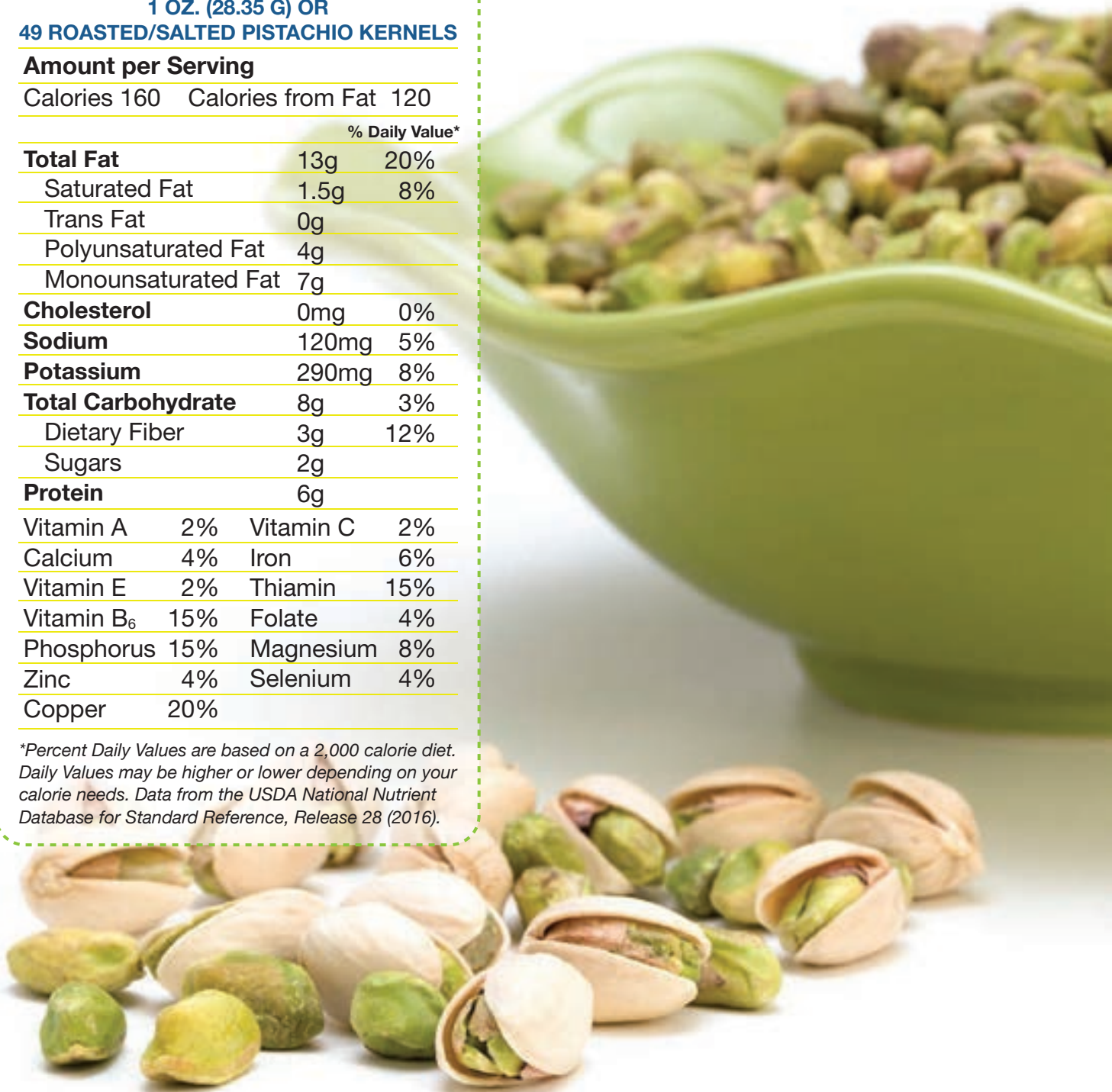
49 ROASTED/SALTED PISTACHIO KERNELS

Amount per Serving

Calories 160 Calories from Fat 120

		% Daily Value*	
Total Fat	13g	20%	
Saturated Fat	1.5g	8%	
Trans Fat	0g		
Polyunsaturated Fat	4g		
Monounsaturated Fat	7g		
Cholesterol	0mg	0%	
Sodium	120mg	5%	
Potassium	290mg	8%	
Total Carbohydrate	8g	3%	
Dietary Fiber	3g	12%	
Sugars	2g		
Protein	6g		
Vitamin A	2%	Vitamin C	2%
Calcium	4%	Iron	6%
Vitamin E	2%	Thiamin	15%
Vitamin B ₆	15%	Folate	4%
Phosphorus	15%	Magnesium	8%
Zinc	4%	Selenium	4%
Copper	20%		

**Percent Daily Values are based on a 2,000 calorie diet. Daily Values may be higher or lower depending on your calorie needs. Data from the USDA National Nutrient Database for Standard Reference, Release 28 (2016).*



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