CALIFORNIA WALNUTS
NUTRITION & SCIENTIFIC RESEARCH
A RESOURCE GUIDE FOR HEALTH PROFESSIONALS
TABLE OF CONTENTS

Why Walnuts? | 4
Essential Omega-3s | 6
Health Research on Walnuts | 9
Heart Health | 10
Healthy Aging | 12
  ° Cognitive Health
  ° Physical Function
Cancer | 14
  ° Breast Cancer
  ° Colorectal Cancer
  ° Prostate Cancer
Diabetes and Metabolic Syndrome | 16
Weight | 18
Mediterranean Diet | 20
Male Reproductive Health | 23
**WHY WALNUTS?**

**WALNUTS ARE THE ONLY NUT** to contain a significant amount of the plant-based omega-3, alpha-linolenic acid (2.5 grams/ounce). One ounce of walnuts also offers four grams of protein, two grams of fiber, and is a good source of magnesium (10% DV). With a variety of nutrients and a flavor profile that pairs well with an array of seasonal foods, they are an ideal ingredient any time of the year.

Walnuts’ unique nutrient profile also makes meeting the 2015-2020 Dietary Guidelines for Americans easy and delicious. The Dietary Guidelines encourage a healthy eating pattern that emphasizes nutrient-dense, plant-based foods and includes a variety of protein sources, including nuts and seeds, seafood, lean meats and poultry, eggs, legumes and soy products.¹

The Dietary Guidelines also emphasize the importance of reducing saturated fat intake to less than 10 percent of calories per day and shifting food choices from those that contain saturated fats to those with polyunsaturated fats. Walnuts are predominantly composed of polyunsaturated fat (13 out of 18 grams of total fat per 1 ounce serving), making them an ideal food to help Americans meet this recommendation.

**A STUDY FROM HARVARD** suggests people who replace saturated fats with polyunsaturated fats in their diet may have a lowered risk of heart disease.² The study analyzed the diets of nearly 85,000 nurses and 43,000 doctors every four years over 30 years. After calculating the percentage of calories the participants received from polyunsaturated fatty acids, monounsaturated fatty acids, whole grain carbohydrates and refined carbohydrates, the study found that substituting 5 percent of the calories from saturated fat with the same amount of energy from polyunsaturated fats was associated with a 25 percent lower risk of coronary heart disease (CHD). Replacing saturated fats with equivalent energy intake from monounsaturated fat or whole grain carbohydrates was associated with a 15 percent and 9 percent lower risk of CHD, respectively.

Given this was an observational study, the findings cannot prove causality and additional research is needed to determine how these results apply to more diverse populations. Furthermore, residual confounding cannot be ruled out (i.e., other lifestyle habits which are more common in adults who eat foods containing polyunsaturated fats, monounsaturated fats and whole grain carbohydrates could contribute to the study results).

---


A DAILY SERVING OF WALNUTS IS:

1 OUNCE

1/4 CUP

12–14 HALVES

1 HANDFUL

**Nutrition Facts for Walnuts**

<table>
<thead>
<tr>
<th>Nutrition Facts for Walnuts</th>
<th>Amount Per Serving</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calories</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Daily Value*</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total Fat</strong></td>
<td>18g</td>
<td>23%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1.5g</td>
<td>8%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
<td></td>
</tr>
<tr>
<td>Polyunsaturated Fat</td>
<td>13g</td>
<td></td>
</tr>
<tr>
<td>Monounsaturated Fat</td>
<td>2.5g</td>
<td></td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td>0mg</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td>0mg</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong></td>
<td>4g</td>
<td>1%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>2g</td>
<td>7%</td>
</tr>
<tr>
<td>Total Sugars</td>
<td>1g</td>
<td></td>
</tr>
<tr>
<td>Incl. 0g Added Sugars</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>4g</td>
<td></td>
</tr>
<tr>
<td><strong>Vitamin D</strong></td>
<td>0mcg</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>30mg</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Iron</strong></td>
<td>0.8mg</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Potassium</strong></td>
<td>130mg</td>
<td>2%</td>
</tr>
</tbody>
</table>

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.*
ESSENTIAL OMEGA-3s

WALNUTS ARE UNIQUE AMONG NUTS for they are primarily comprised of polyunsaturated fatty acids, or PUFAs, with 13 out of 18 grams of total fat per one ounce serving. Many other nuts contain mostly monounsaturated fatty acids (MUFAs). As a result, walnuts are the only nut that offer an excellent source of the plant-based omega-3 alpha-linolenic acid or ALA (2.5 grams per 1 ounce serving). Research specific to ALA and its contribution to health benefits continues to evolve.

Based on findings from a literature review, ALA may be as effective in reducing the risk of cardiovascular disease (CVD) as marine-derived omega-3s, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have been shown to be. This review presented evidence for a beneficial role of ALA in the primary and secondary prevention of CVD.

OMEGA-3 OVERVIEW

The predominant essential fatty acids in the human diet are alpha-linolenic acid (ALA, an omega-3 fatty acid) and linoleic acid (LA, an omega-6 fatty acid). ALA is the precursor or “parent” to two important long-chain omega-3 fatty acids: eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

In recent years, the number of studies describing the health-promoting benefits of omega-3 fatty acids has increased substantially, primarily in the area of heart health.

The role of ALA in the body relates to structural membrane lipids and a lack of ALA can result in a deficiency. The Dietary Reference Intake report that includes fatty acids set an adequate intake (AI) for ALA at 1.6 and 1.1 grams per day for men and women, respectively. While deficiency is rare, meeting the AI for ALA can provide the beneficial health effects associated with consumption of omega-3 fatty acids.

THE ONLY NUT SIGNIFICANTLY HIGH IN OMEGA-3

ALPHA-LINOLENIC ACID – ALA (C18:3)
(Found in walnuts, flaxseed, soybean oil, canola oil)

EICOSAPENTAENOIC ACID – EPA (C20:5)
(Found in fatty fish including salmon, mackerel, trout)

DOCOSAHEXAENOIC ACID – DHA (C22:6)
(Found in fatty fish including salmon, mackerel, trout)
RESEARCH FROM THE LANDMARK PREVENCION CON DIETA MEDiterranea (PREDIMED) study, one of the largest clinical trials, found that both plant and marine-based sources of omega-3s have complementary effects against mortality in a population with high seafood consumption. This secondary analysis looked at data from participants in the PREDIMED study. A total of 7,447 Spanish subjects (ages 55-80) at high risk of cardiovascular disease, but with no symptoms at baseline, were enrolled in the PREDIMED study and followed for an average of 4.8 years. Subjects were randomly assigned to a Mediterranean diet supplemented with mixed nuts (15g walnuts, or about 0.5 ounces, 7.5g almonds and 7.5g hazelnuts per day), a Mediterranean diet supplemented with extra virgin olive oil (at least 50g or 4 tablespoons per day) or a low-fat diet (control group). The study found that consuming omega-3s from plant-based sources, such as walnuts, may reduce risk of all-cause mortality, whereas marine-derived omega-3s, from fatty fish, may reduce the risk of heart-related fatalities. The greatest protective effects from total mortality were observed in diets that included both plant-based and marine-derived omega-3s, as they appear to act synergistically.

Though the findings cannot prove causality, the research demonstrates that ALA may provide additional health benefits even in a population with high consumption of EPA and DHA from seafood.

RESEARCH IN A MILLENNIAL population (ages 18-35) exhibited regularly eating foods that contain PUFAs, including walnuts, salmon, tuna, flaxseed oil, grapeseed oil, canola oil and fish oil supplements, may significantly improve fat metabolism and protect against the negative effects of saturated fats such as high cholesterol levels. For the study, researchers placed 26 healthy adults (13 men and 13 women) on a diet rich in polyunsaturated fats (21% polyunsaturated fat, 9% monounsaturated fat, and 5% saturated fat) or a control diet that was a typical American pattern (7% of polyunsaturated fat, 15% monounsaturated fat and 13% saturated fat) for seven days and had them consume a meal high in saturated fat (7% of polyunsaturated fat, 16% monounsaturated fat and 47% saturated fat) before and after the seven day diet. The diet rich in PUFAs was achieved by participants’ consuming the whole foods described above in conjunction with fish oil supplements. Researchers observed significant decreases in total cholesterol (TC) and low-density lipoprotein (LDL) levels in the study participants who followed an eating plan rich in PUFAs, even though they were young, healthy and didn’t have high cholesterol levels when the study began.

Residual confounding cannot be ruled out in observational studies (i.e., other lifestyle habits which are more common in adults who eat foods containing omega-3s could contribute to the study results). Larger and longer-term studies, as well as studies in diverse populations, are needed to clarify population-wide effects. Additionally, more clinical trials are needed to evaluate the effects of ALA intake on cardiovascular disease risk as well as determine the optimal quantity of all dietary omega-3 PUFAs to offer the greatest health benefit. In the context of whole food diet, it is difficult to discern whether changes seen with the Mediterranean or PUFA-rich diet can be attributed to one specific type of PUFA, food source, or a combination of overall dietary factors.

For more than 25 years, the California Walnut Commission has supported scientific research on consumption of walnuts and outcomes in the following areas:

Heart Health

Healthy Aging
  - Cognitive Health
  - Physical Function

Cancer
  - Breast Cancer
  - Colorectal Cancer
  - Prostate Cancer

Diabetes and Metabolic Syndrome

Weight

Mediterranean Diet

Male Reproductive Health
WALNUTS & HEART HEALTH

SINCE 1993, published research has been investigating how eating walnuts affects various heart health biomarkers and risk markers including:

- LDL and HDL cholesterol
- Apolipoprotein B and non-HDL cholesterol
- Blood pressure
- Inflammation
- Endothelial function
- Plaque formation

Roasted Vegetables with Walnuts, Basil and Balsamic Vinaigrette

WALNUTS ARE CERTIFIED BY THE AMERICAN HEART ASSOCIATION WITH THE HEART-CHECK MARK

PER 1 OZ. SERVING

Please note that the Heart-Check Food Certification does not apply to scientific research by an organization other than the AHA unless expressly stated. For more information, see the AHA nutrition guidelines at: heartcheckmark.org/guidelines.
THE RESEARCH SUPPORTING the role that walnuts can play in heart health began with a Loma Linda University study, showing walnuts may lower total and LDL cholesterol in men by as much as 12 percent and 16 percent, respectively.¹ In this eight-week randomized, crossover trial, 18 healthy men (ages 21-43) were assigned to a cholesterol-lowering diet that did not include nuts or a cholesterol-lowering diet that included walnuts. All food was provided by the researchers and the walnut diet contained three servings (equivalent to 3 ounces) of walnuts per day.

A HARVARD UNIVERSITY META-ANALYSIS reviewed the heart health benefits of walnuts in 13 different trials. The trials represented 365 individuals, including those with a variety of characteristics such as high cholesterol, type 2 diabetes, metabolic syndrome and overweight or obesity, and those that were healthy.² When compared with control diets, such as a low-fat diet, Mediterranean-style diet or traditional American or Japanese diet, a diet supplemented with walnuts in amounts varying from 5-25 percent of total calories per day (equivalent to 1-3.9 ounces per day) resulted in a significantly greater decrease in total cholesterol (-10.29 mg/dL, -4.9%) and LDL cholesterol (-9.23 mg/dL, -6.7%). In addition, according to the studies in the analysis, walnuts provided significant benefits for certain antioxidant capacity and inflammatory markers and had no adverse effects on body weight.

Due to the evidence supporting the cardiovascular benefits of walnuts, the U.S. Food and Drug Administration approved one of the first qualified health claims for a whole food in March of 2004: “Supportive but not conclusive research shows that eating 1.5 ounces of walnuts per day, as part of a low saturated fat and low cholesterol diet, and not resulting in increased caloric intake may reduce the risk of coronary heart disease.”³

Larger and longer-term studies, as well as studies in more diverse populations, are needed to clarify population-wide effects.¹²³ In some cases, the amount of walnuts consumed in these trials was relatively large and might be difficult to maintain in a non-research setting.¹² A meta-analysis offers a comprehensive look at findings among patients of various backgrounds, however, it can be limited by the methods, reported outcomes and quality of the individual studies involved.² In the PREDIMED study, it is difficult to precisely define what part of the Mediterranean diet was associated with cardiovascular benefits.³

SYNERGISTIC EFFECTS OF WALNUTS or their bioactive components may be contributing factors in protecting against the detrimental effects of aging. Research shows that nutrients found in walnuts, such as polyphenols, tocopherols and polyunsaturated fatty acids, may reduce oxidative stress and inflammation as well as help maintain neural membrane integrity and reduce protein aggregation involved in Alzheimer’s disease.¹ Though more research is needed to confirm the benefits in humans, a review of animal studies suggests that the addition of walnuts (equivalent to a single serving or 1 ounce of walnuts for humans) is associated with improved motor and cognitive behavior in aged animals. Additionally, human studies have shown that the inclusion of walnuts in the diet may improve cardiovascular health, which is a risk factor for neurodegenerative diseases and age-related cognitive decline.

Together, the evidence suggests that including walnuts as part of a healthy diet may play a role in helping to maintain and improve physical and cognitive health as people age.

COGNITIVE HEALTH

A STUDY PUBLISHED in the Journal of the American Medical Association Internal Medicine found that eating a Mediterranean diet supplemented with olive oil or nuts (primarily walnuts) was correlated with reduced age-related decline in cognitive function in an older Spanish population (ages 55-80) at high cardiovascular risk.² This clinical trial was conducted in a subcohort of the PREvención con Dieta MEDITerránea (PREDIMED) trial. Participants were randomly assigned to a Mediterranean diet supplemented with mixed nuts (15g walnuts, or about 0.5 ounces, 7.5g almonds and 7.5g hazelnuts per day), a Mediterranean diet supplemented with extra virgin olive oil (at least 50g or 4 tablespoons per day) or a low-fat diet (control group). The study found that participants who consumed a Mediterranean diet with nuts, including walnuts, showed improvements in memory compared to a low-fat diet.

AN ANIMAL STUDY PUBLISHED in the Journal of Alzheimer’s Disease demonstrated that a diet including walnuts may have a beneficial effect in reducing the risk, delaying the onset, or slowing the progression of Alzheimer’s disease.⁴ The research group examined the effects of dietary supplementation with 6 percent or 9 percent walnuts in mice (equivalent to 1 ounce and 1.5 ounces of walnuts per day in humans) compared to a control diet with no walnuts. The study found significant improvement in learning skills, memory, anxiety reduction, and motor development in mice fed a walnut-enriched diet. This research stemmed from a previous cell culture study that highlighted the protective effects of walnut extract against the oxidative damage caused by amyloid beta protein, the major component of amyloid plaques that form in the brains of those with Alzheimer’s disease.⁵ Findings from animal and cell studies are provided as background and used to formulate hypotheses for additional research needed to determine the effects on humans.
Physical Function

Findings published in the Journal of Nutrition suggest that consumption of one to two servings of walnuts per week (1 ounce per serving) was associated with reduced risk of developing impairments in physical function in older women, which may help to maintain independence throughout the aging process. Researchers looked at data from 54,762 women in the prospective Nurses’ Health Study, which tracked women for more than 30 years. This paper emphasized that overall diet quality, rather than individual foods, may have a greater impact on reducing risk of physical function impairments. Specifically, diet quality traits most associated with reduced rates of incident physical impairment were higher intake of fruits and vegetables; lower intake of sugar-sweetened beverages, trans fat, and sodium; and moderate alcohol intake. Among food components, the strongest relations were found for increased intakes of walnuts, oranges, orange juice, apples, pears and romaine or leaf lettuce.

Residual confounding cannot be ruled out (i.e., other lifestyle habits which are more common in adults who eat walnuts could contribute to the study results) and findings cannot prove causality in observational studies. More research is also needed to clarify how the health benefits apply to other populations. In the context of a Mediterranean diet, it is difficult to precisely define what part of the diet is associated with cognitive health.

Breast Cancer

Animal research published in *Nutrition and Cancer* looked at the role of walnut consumption on potential breast cancer protection in maternal mice and their offspring. Researchers found that a diet including a modest amount of walnuts (equivalent to 2 ounces per day for humans) was associated with a decreased risk of breast cancer in mice. Maternal mice were randomized to a control diet with corn oil or a diet containing walnuts, and both diets were designed to be isocaloric and isonutrient. The maternal mice were then bred with male mice and the offspring were randomized to the same two diets after weaning. The findings showed a significant reduction in tumor incidence, number and size in maternal and offspring mice that consumed walnuts compared to mice that did not consume walnuts. Although more research is needed to determine the specific components of walnuts and the mechanisms associated with tumor suppression, the findings demonstrate that walnuts may contribute to a healthy diet to reduce risk for breast cancer in mice.

PreliMinary animal and cell model research has been investigating the potential benefit walnuts may have on a variety of cancers including breast, prostate and colorectal. Please note that the following animal and cell studies are provided as background and used to formulate hypotheses for additional research needed to determine the effects on humans.

A review of animal research published in *The Journal of Nutrition* demonstrates that walnuts may have multiple nutrients that could act in various ways to help decrease the risk of developing cancer. The studies reviewed suggest that these nutrients act together to provide more benefit than would be expected from the individual components.

Grain Salad with Toasted Walnuts, Dates and Grapefruit
Colorectal Cancer

AN ANIMAL STUDY PUBLISHED in Cancer Prevention Research found that eating walnuts could modify gut bacteria in a way that is beneficial to colon health, and may be associated with colon tumor suppression. In the study, researchers incorporated walnuts into two different diets, a standard mouse diet supplemented with 0, 15, 22.5, or 30.2 percent of calories from walnuts, and a Western diet, representing typical American intake, supplemented with 0, 5.2, 10.5, or 21.4 percent of calories from walnuts. Calories from fat sources were proportionally lowered in each diet to compensate for the addition of walnuts. Male mice fed a Western diet with 10.5 percent of total calories from walnuts, which translates to just over one ounce of walnuts in a human diet, showed a significant reduction in the number and size of tumors.

Animal research conducted at the Beth Israel Deaconess Medical Center and Harvard Medical School demonstrated that walnuts in the diet may inhibit colorectal cancer growth in mice by suppressing angiogenesis. In this study, mice with human colon cancer cells were randomized to diets containing approximately 19 percent of total energy from corn oil (control diet), flaxseed oil or ground walnuts (approximately 2 ounces of walnuts in a human diet). Compared with the corn oil diet, mice fed the walnut diet (equivalent to 2 servings of walnuts per day in humans) or flaxseed diet exhibited significantly slower tumor growth rates and lower tumor weights. The differences between walnut and flaxseed diets did not reach statistical significance. However, compared to the control-fed mice, consumption of walnuts significantly decreased angiogenesis which may be beneficial against the progression of colorectal cancer.

Prostate Cancer

WALNUTS CONTAIN SEVERAL BIOACTIVE compounds including ellagitannins (ETs), a type of polyphenol. After consumption, ETs are metabolized to release ellagic acid (EA), which is further metabolized by gut microbiota to form urolithins, such as A (UA) and B (UB).

A cell study published in the European Journal of Nutrition looked at gene expression in prostate cancer cells and found that UA, the main human metabolite of walnut polyphenols, may help to inhibit or reduce the risk of prostate cancer from developing. Similarly, another cell study showed that a diet rich in ET-containing foods, such as walnuts, could contribute to the prevention of prostate cancer by influencing the regulatory mechanisms in prostate cancer.

Research published in Cancer Investigation showed that walnuts may help reduce prostate cancer risk in mice. In this experimental study, mice were fed either a standard mouse diet (control diet) or a standard mouse diet enriched with walnuts (equivalent to 2 ounces of walnuts per day in humans). The final average tumor size in the walnut-fed mice was approximately 25 percent the average size of the prostate tumors that developed in the mice that consumed the non-walnut control diet.

INDIVIDUALS WITH DIABETES or metabolic syndrome often have conditions such as high blood pressure, abnormal cholesterol, high triglycerides and obesity. Together, these disorders increase the risk for heart disease and stroke. Research on the association between walnut consumption and these conditions demonstrate the importance of walnuts as part of a healthy diet to help manage complications associated with diabetes and metabolic syndrome.

RESEARCHERS FROM HARVARD found that walnut consumption was associated with a significantly lower risk of type 2 diabetes in women compared with women who never/rarely consumed walnuts. The study looked at two large prospective cohorts of U.S. women: The Nurses’ Health Study (NHS) and NHS II, which followed 58,063 women (ages 52-77) in NHS (1998-2008) and 79,893 women (ages 35-52) in NHS II (1999-2009) without diabetes, cardiovascular disease or cancer at baseline. They found two or more servings (1 serving is equivalent to 1 ounce) of walnuts per week, as part of a healthy diet, was associated with a 21 percent and 15 percent lower risk of incident type 2 diabetes before and after adjusting for body mass index (BMI), respectively.

A STUDY PUBLISHED in Metabolism found that short-term consumption of walnuts may improve blood lipids, by increasing apolipoprotein A concentration. Apolipoprotein A is the primary protein component of HDL, and is one of many factors that may be considered in a complete lipid profile when estimating cardiovascular disease risk. For this study, 15 obese subjects (ages 56-61) with metabolic syndrome were enrolled in a randomized, double-blinded, placebo-controlled crossover study in which they consumed two different isocaloric diets, one with 48 grams of walnuts daily (approximately 1.7 ounces) and one without walnuts for four days each. The results suggest that eating walnuts may have a beneficial effect on lipid metabolism even within short-term consumption.

FINDINGS FROM THE YALE-GRiffin PREVENTION RESEARCH CENTER demonstrated that consumption of a diet enriched with two ounces of walnuts per day for eight weeks significantly improved endothelial function in 24 adult participants (ages 49-67) with type 2 diabetes. Subjects were randomly assigned to an ad libitum diet enriched with 56 grams of walnuts per day or an ad libitum diet without walnuts. Researchers compared the dietary effects on endothelial function, a measure of how well blood vessels are able to dilate, resulting in increased blood flow, and a powerful predictor of overall cardiovascular risk. The same design was used in another study with 46 overweight adults with elevated waist circumference and one or more additional signs of metabolic syndrome. Findings showed that daily consumption of 56 grams of walnuts for eight weeks significantly improved endothelial function as compare with an ad libitum diet not supplemented with walnuts.

Larger and longer-term studies, as well as studies in more diverse populations, are needed to clarify population-wide effects. In some cases, residual confounding cannot be ruled out (i.e., other lifestyle factors which are more common in adults who eat walnuts could contribute to the study results).
Research has found that including the right type of fats, like those found in walnuts, can be beneficial to people with diabetes.
WALNUTS & WEIGHT

A SHORT-TERM STUDY from researchers at Beth Israel Deaconess Medical Center and Harvard Medical School found that walnuts may increase satiety and sense of fullness.¹ Twenty men and women (ages 57-61) with metabolic syndrome participated in this randomized, double blind, cross-over study. For four days, subjects consumed isocaloric diets including a liquid meal containing either 48g of walnuts (approximately 1.7 ounces) or no walnuts. Both meals had similar macronutrient composition with the placebo rich in monounsaturated fats (MUFAs) and the walnut meal being rich in polyunsaturated fats (PUFAs). Walnuts are primarily comprised of PUFAs with 13 out of 18 grams of total fat per one ounce serving. By day three of the study, subjects on the walnut-containing diet reported feeling more satiated and had a significantly higher rate of feeling full compared to those on the placebo diet. Due to the short study duration, further long-term studies are needed to explore the role of walnuts on these outcomes.

A STUDY PUBLISHED in Nutrition, shares that millennials who regularly consume foods that contain PUFAs may experience favorable changes in appetite hormones associated with hunger and satiety.² Twenty-six healthy adults (ages 18-35) visited a lab for measurements and to receive all meals throughout the study. Participants were measured and consumed test meals high in saturated fat at the beginning of the study. They were then placed on a seven-day control diet consisting of a typical American eating pattern or a diet high in PUFAs (included whole foods such as walnuts, Alaska salmon, tuna, flaxseed oil, grapeseed oil, canola oil, and fish oil supplements). After the seven-day diet, participants consumed meals high in saturated fat at the beginning of the study. They were then placed on a seven-day control diet consisting of a typical American eating pattern or a diet high in PUFAs (included whole foods such as walnuts, Alaska salmon, tuna, flaxseed oil, grapeseed oil, canola oil, and fish oil supplements). After the seven-day diet, participants consumed meals high in saturated fat, again. Study participants that consumed a PUFA-rich diet had a significant decrease in fasting ghrelin, a hormone that increases hunger, and a significant increase in peptide YY (PYY), a hormone that increases fullness or satiety. Participants saw increases in PYY while fasting and after consuming a meal. These types of hormone changes could help with better appetite control although it is difficult to discern whether the changes can be attributed to one specific type of PUFAs, food source, or a combination of overall dietary factors.

IN ANOTHER STUDY PUBLISHED in the Journal of the American Heart Association and Metabolism, researchers found that a diet containing unsaturated fats, such as those found in walnuts and olive oil, may have similar effects on weight loss as compared to a lower fat, higher carbohydrate diet among overweight and obese women.³,⁴ Two hundred forty-five women (ages 22-72) were enrolled in a one-year behavioral weight loss intervention and randomly assigned to three different diets: 1) a lower fat, higher carbohydrate diet (excluded nuts), 2) a lower carbohydrate, higher fat diet (excluded nuts), or 3) a walnut-rich (1.5 ounces per day), higher fat, lower carbohydrate diet, with guidance to reduce energy intake by 500-1000 calories per day. Participants on the lower fat diet were instructed to emphasize lean protein sources, reduced-fat dairy foods, vegetables, fruit and whole grains. Whereas participants on the lower carbohydrate diet were educated about lower carbohydrate choices, lean protein sources, and how to achieve a high MUFA intake. Weight loss was similar across the diet groups, demonstrating that walnuts may play a role in achieving ideal body weight in overweight and obese women, when consumed as part of an overall healthy diet; however, more research is needed to clarify the results in men.

Salmon with Stewed Chickpeas and Kale
A Fresh Look at the Calorie Content of Walnuts

A study from the United States Department of Agriculture (USDA) found that one serving of walnuts (1 ounce) may provide 146 calories, which is 39 calories less, or 21 percent fewer, than the 185 calories listed in the USDA Nutrient Database. The research team studied 18 healthy adults. Each person was assigned randomly to a sequence of two isocaloric diets: A controlled American diet without walnuts for a three-week period, and a controlled diet with 1.5 servings of walnuts (1.5 ounces) for another three-week period. Administered meals as well as walnut, fecal and urine samples were collected and subjected to bomb calorimetry to measure calories. The data from each was used to calculate the metabolizable energy of the walnuts. The study took into account the digestibility of walnut pieces and halves and further research is needed to better understand the results of the study and how this technique for calculating calories could potentially affect the calorie count of other foods.

Improved Diet Quality

As a nutrient-dense food, walnuts can be eaten in place of less healthy choices to improve overall diet quality. A study from Yale University found that including walnuts in a habitual diet, with or without dietary counseling to adjust calorie intake, significantly improved diet quality in adult men and women at high risk for diabetes. Diet quality was assessed using the Healthy Eating Index 2010 (HEI-2010). In this parallel design study, participants (31 men and 81 women ages 25–75) were assigned to a calorie adjusted diet or an ad libitum diet. The two diet groups were further randomized to one of two diet sequences to either include or exclude walnuts for 6 months, followed by a three-month washout period consisting of an ad libitum diet without walnuts, and then to either exclude or include walnuts for another 6 months. During the walnut-included diet, participants were provided 392 grams of walnuts per week (2 ounces per day) to include in their diet. Subjects on the calorie adjusted diet met with a registered dietitian to maintain isocaloric conditions after incorporating walnuts in the diet whereas individuals on the ad libitum diet were not monitored or regulated.

Information on dietary intake and diet adherence may have been limited in studies where participants were free-living and data was self-reported. Although larger and longer-term studies, as well as studies in more diverse populations, are needed to understand population-wide effects, walnuts can play a role in optimal body weight and improving overall diet quality, when consumed as part of a healthy diet.

THERE ARE VARIOUS FORMS of the Mediterranean diet, which emphasizes more fruits and vegetables, nuts and seeds (including walnuts), grains, olive oil, moderate amounts of fish, poultry, eggs and wine, and limits the amounts of red meat, processed meat, dairy and sweets. The U.S. 2015-2020 Dietary Guidelines for Americans recommends a Mediterranean-style eating pattern as one example of a healthy diet plan.

PREDIMED (PREvención con Dieta MEDITERRánea = Prevention with Mediterranean Diet) is a landmark study aimed at assessing the efficacy of the Mediterranean diet in the primary prevention of cardiovascular diseases. The seminal paper, “Primary Prevention of Cardiovascular Disease with a Mediterranean Diet” was published in 2013 and more than 200 additional studies have resulted from the PREDIMED research.

The aim of PREDIMED was to determine whether a Mediterranean diet supplemented with extra-virgin olive oil or mixed tree nuts (50% walnuts, 25% almonds, and 25% hazelnuts), compared to a low-fat diet, can help reduce the risk of major cardiovascular events, including cardiovascular death, myocardial infarction (heart attack) and stroke.

The study was a parallel group, multi-center, single blind, randomized clinical trial that was conducted by 16 research groups and seven communities and supported by the Spanish Health Ministry. Participants included 7,447 Spanish individuals (ages 55-80) at high risk of cardiovascular disease, but without symptoms at baseline, and were followed for an average of 4.8 years. Subjects were randomly assigned to one of three diet groups, content listed below, and were given dietetic support and educational sessions to ensure compliance. Energy intake was not specifically restricted in any intervention group.

PREDIMED DIET GROUPS

1. Mediterranean diet supplemented with **MIXED NUTS** (30 g per day; 15g walnuts (about 0.5 ounces), 7.5g almonds and 7.5g hazelnuts)

2. Mediterranean diet supplemented with **EXTRA VIRGIN OLIVE OIL** (at least 50g or 4 tablespoons per day)

3. **LOW-FAT DIET** (control group; American Heart Association guidelines)
A Mediterranean diet including tree nuts, primarily walnuts, reduced the risk of cardiovascular diseases (myocardial infarction, stroke or cardiovascular death) by 30 percent and specifically reduced the risk of stroke by 46 percent when compared to the low-fat diet.

The Mediterranean diet enriched with extra-virgin olive oil also reduced the risk of cardiovascular diseases by 30 percent. Several studies have been published since the seminal paper investigating the Mediterranean diet on a number of outcomes including cognitive function, blood pressure, total cholesterol and fasting glucose.

The study had some limitations including the fact that participants lived in a Mediterranean country and were at high risk for cardiovascular disease. More studies are needed to clarify the health benefits in other populations. Additionally, it is difficult to precisely define what part of the Mediterranean diet was associated with cardiovascular benefits.

Interested in more resources? Oldways, a non-profit food and nutrition education organization, has created numerous helpful resources on the Mediterranean diet.

6 http://www.oldwayspt.org/
Toasted Walnut Hummus
WALNUTS & MALE REPRODUCTIVE HEALTH

THE AMERICAN SOCIETY FOR REPRODUCTIVE MEDICINE has found evidence that infertility affects men and women equally with about one-third of infertility cases being attributed to male factors, and about one-third to factors that affect women.¹ Throughout history, food has been linked with human reproductive success, however most emphasis has been on the maternal diet and little focus has been given to the paternal diet.

Findings from walnut health studies have provided encouraging results regarding men’s reproductive health research and walnuts may play a role.

A study of healthy young men (ages 21-35), who ate 75 grams (approximately 2.5 ounces) of walnuts per day experienced positive shifts in sperm quality factors, including sperm vitality, motility (movement) and morphology (form).² Sperm quality is an indicator of male fertility.³ This randomized, parallel two-group dietary intervention trial included 117 participants who routinely ate a Western-style diet. Approximately half were assigned to consume 75 grams of walnuts per day for 12 weeks as part of their usual diet, while the remaining half followed their typical diet but avoided consumption of tree nuts.

Consuming walnuts may have contributed to shifts in certain sperm quality factors in these healthy young men, but more research is needed to understand how these findings impact the broader male population, including men in fertility clinics. This study also reported higher amounts of alpha-linolenic acid (ALA) provided by walnuts correlated with less frequent sperm aneuploidy (abnormal cell chromosome numbers), which can result in genetic abnormalities such as Down syndrome.

Walnuts are the only nut with an excellent source of ALA, the plant-based omega-3 fatty acid (2.5 grams/ounce).

Another study, in an animal model, explored possible mechanistic reasons for the results seen in the clinical trial. Mice fed a walnut-rich diet showed a reduction in lipid peroxidation, a process that can damage sperm cells.⁴ This form of cell damage harms sperm membranes, which are primarily made up of polyunsaturated fatty acids (PUFAs). Previous studies have shown that PUFAs may play a role in sperm health and membrane function. Walnuts are the only tree nut that are predominantly comprised of PUFAs (1 ounce contains 13 grams of PUFAs out of 18 grams of total fat), which is why they were included in this study. This promising animal research provides important insight, but the results are inconclusive regarding the effects on humans and how PUFAs function to reduce lipid peroxidation. Future human clinical studies are needed.

Additional limitations should be considered for the clinical trial. Information on dietary intake and adherence was limited since participants were free-living and self-reported data. Collection of blood specimens for hormone analysis occurred throughout the day, to accommodate busy schedules of the subjects, but participants were asked to attend follow-up appointments at similar times for consistent data collection.
