Nuts to You!

The Health Benefits of Nature's Arboreal Bounty - in a Nutshell

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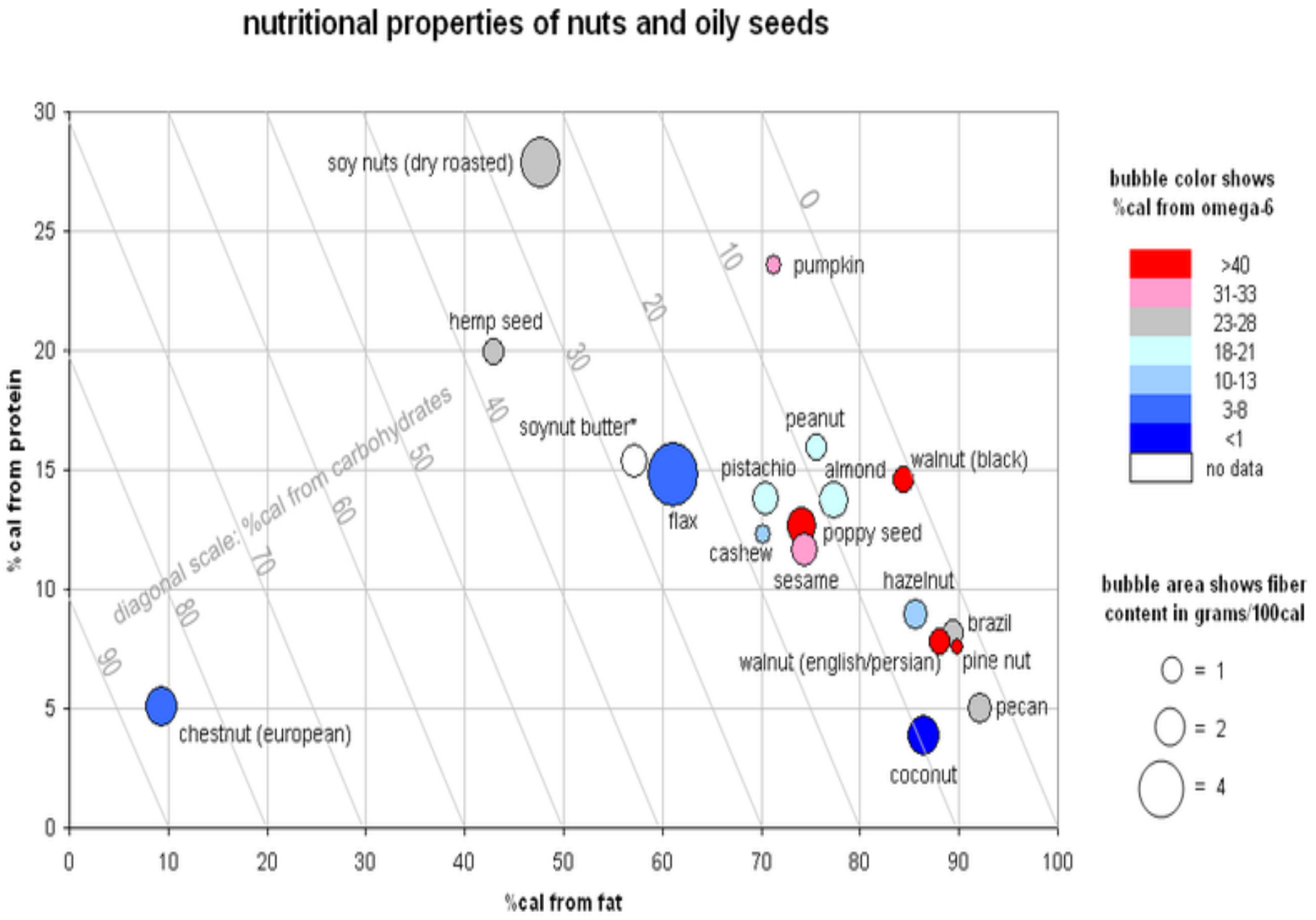
Nuts: The Superfood!

Nuts are one food around which a consensus has developed: HEALTHY!

Nut consumption is associated with lower all-cause mortality, heart disease, diabetes, cancer and respiratory disease

Nuts are Healthy?!?

You gotta be kidding! Everyone knows that nuts are chock full o' fat, and everyone knows that fat isn't good for you, right?


nutritional properties of nuts and oily seeds
% cal from protein
%cal from fat
diagonal scale: %cal from carbohydrates
soy nuts (dry roasted)
pumpkin
hemp seed
soynut butter*
peanut
pistachio
almond
walnut (black)
flax
poppy seed
cashew
sesame
hazelnut
brazil
walnut (english/persian)
pine nut
pecan
chestnut (european)
coconut
bubble color shows %cal from omega-6
>40
31-33
23-28
18-21
10-13
3-8
<1
no data
bubble area shows fiber content in grams/100cal
= 1
= 2
= 4

Nutrient Content of Nuts

Table 1. Average nutrient composition of nuts (per 100 g).

Nuts	Energy (kJ)	Fat (g)	SFA (g)	MUFA (g)	PUFA (g)	LA (g)	ALA (g)	Protein (g)	Fiber (g)	Folate (µg)	PS (mg)
Almonds	2418	50.6	3.9	32.2	12.2	12.2	0.00	21.3	8.8	29	120
Brazil nuts (dried)	2743	66.4	15.1	24.5	20.6	20.5	0.05	14.3	8.5	22	NR
Cashews	2314	46.4	9.2	27.3	7.8	7.7	0.15	18.2	5.9	25	158
Hazelnuts	2629	60.8	4.5	45.7	7.9	7.8	0.09	15.0	10.4	113	96
Macadamia nuts	3004	75.8	12.1	58.9	1.5	1.3	0.21	7.9	6.0	11	116
Peanuts	2220	49.2	6.8	24.4	15.6	15.6	0.00	25.8	8.5	145	220
Pecans	2889	72.0	6.2	40.8	21.6	20.6	1.00	9.2	8.4	22	102
Pine nuts (dried)	2816	68.4	4.9	18.8	34.1	33.2	0.16	13.7	3.7	34	141
Pistachios	2332	44.4	5.4	23.3	13.5	13.2	0.25	20.6	9.0	51	214
Walnuts	2738	65.2	6.1	8.9	47.2	38.1	9.08	15.2	6.4	98	72

What is a nut?

A nut is a simple dry *fruit* with one seed in which the ovary wall becomes very hard (stony or woody)

Botanically, fruit consists of the seed, which propagates the plant, along with its energy supply to start germination and a protective outer layer

Nutritional Content of Nuts

100 g of nuts = ~3.5 oz = ~3 servings

Fiber: 6-10 g (2-3 g / serving)

- Virtually no sugar; no refined carbs

Protein: 8-25 g (3-8 g / serving)

Fat: 45-75 g (15-25 g / serving)

- Mostly MUFA and PUFA
- Walnuts high in plant Ω-3 (ALA)

Calories: 600-750 cal (200-250 cal / serving)

- Calories mainly from fat

Phytosterols

- Cholesterol-like molecules from plants that, in adequate dietary amounts, can lower blood cholesterol

Origin of "Nuts are Good for You" - the Adventist Health Study

Seventh-Day Adventists are a Protestant denomination with distinct beliefs and behaviors.

Since the church began in the 1860s, wholeness and health have been an emphasis.

Use of tobacco, alcohol, and – among some – caffeine beverages are avoided.

Vegetarianism is recommended, and abstinence from pork, shellfish and other "unclean" foods is observed. Nuts and legumes are prominent part of diet.

The modern concept of "commercial cereal food" originated among Adventists, notably John Harvey Kellogg, whose brother William founded the famous cereal company.

The observation that California Adventists seemed to have lower overall mortality than age-matched Californians led to NIH supported studies to see if they could tell why.

Adventist Health Study

From 1974-1988, 34,000 California Adventists were surveyed to determine their eating habits and other personal behaviors, then followed to find out how many developed various diseases and/or died.

Nuts & Health - Origins

In 1992, Fraser *et al* reported from the Adventist Health Study: "Our data strongly suggest that the frequent consumption of nuts may protect against risk of CHD events."

Among 31,208 non-Hispanic white California Seventh-Day Adventists followed prospectively, those who consumed nuts more than 4 times per week had 48% fewer CHD deaths and 51% fewer non-fatal MI than those eating nuts less than once per week

Walnut feeding experiment

Sabaté *et al* - NEJM - 1993

18 healthy men fed a cholesterol-lowering diet for 8 weeks in a research kitchen at Loma Linda University; 30% calories from fat

During 4 of the weeks, 20% of the calories came from walnuts, about 3 oz / 2500 Cal

Cross-over design, so each man was on both arms of the experiment, with and without walnuts, the order randomly assigned and stratified

Walnut feeding study - results

LDL fell 16% during the walnut feeding

Total cholesterol fell 12% during walnut feeding

HDL fell 5%

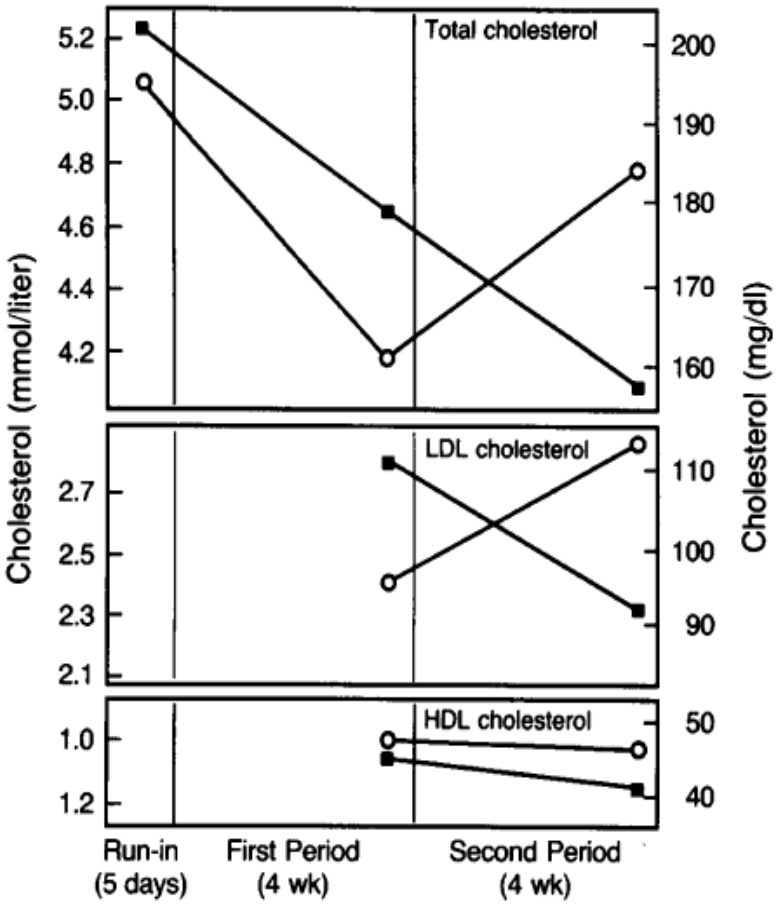


Figure 1. Mean Serum Concentrations of Total, LDL, and HDL Cholesterol during Each Diet Period.

All 18 subjects followed each diet, but 10 followed the walnut diet first (○) and 8 followed the reference diet first (■).

Walnut feeding study - conclusions

Adding walnuts to a standard cholesterol lowering diet provides significant further lowering in LDL and total cholesterol that would be anticipated to produce further benefit in lowering the risk of CHD

Nuts and Mortality

Ten Years of Life: Is It a Matter of Choice?

- Fraser and Shavlik, 2001, Arch. Int. Med.

Analysis of the California Seventh-Day Adventists (34,000) for mortality, compared to contemporaneous Californians

5193 deaths among Adventists

- 26% CHD, 10% CVA, 21% Ca

Risk factor analysis within the Adventist group

- Diet, exercise, smoking, BMI

Adventist Study: Conclusions

Years of additional survival due to significant independent potentially-modifiable risk factors among Adventists (men, women)

- Vegetarian diet vs. non-veg (1.53, 1.51)
- High exercise vs. low (2.73, 1.88)
- High nuts vs. low (2.74, 1.87)
- Low BMI vs. high (1.41, 2.25)
- Former smoking vs. never (1.25, 1.80)
- Hormone replacement therapy vs. none (N/A, 1.06)

"Independent" implies survival impacts are additive

All variables at favorable vs. all at unfavorable

- +10.8 years for men, +9.8 years for women

Average Adventist lost slightly greater than 4 years of survival due to sub-optimal lifestyle choices

Adventist Study: Conclusions

Nuts were the most prominent single dietary category associated with longevity

Effect of nuts on par with vegetarian vs. non-vegetarian, level of exercise

Further nut feeding studies

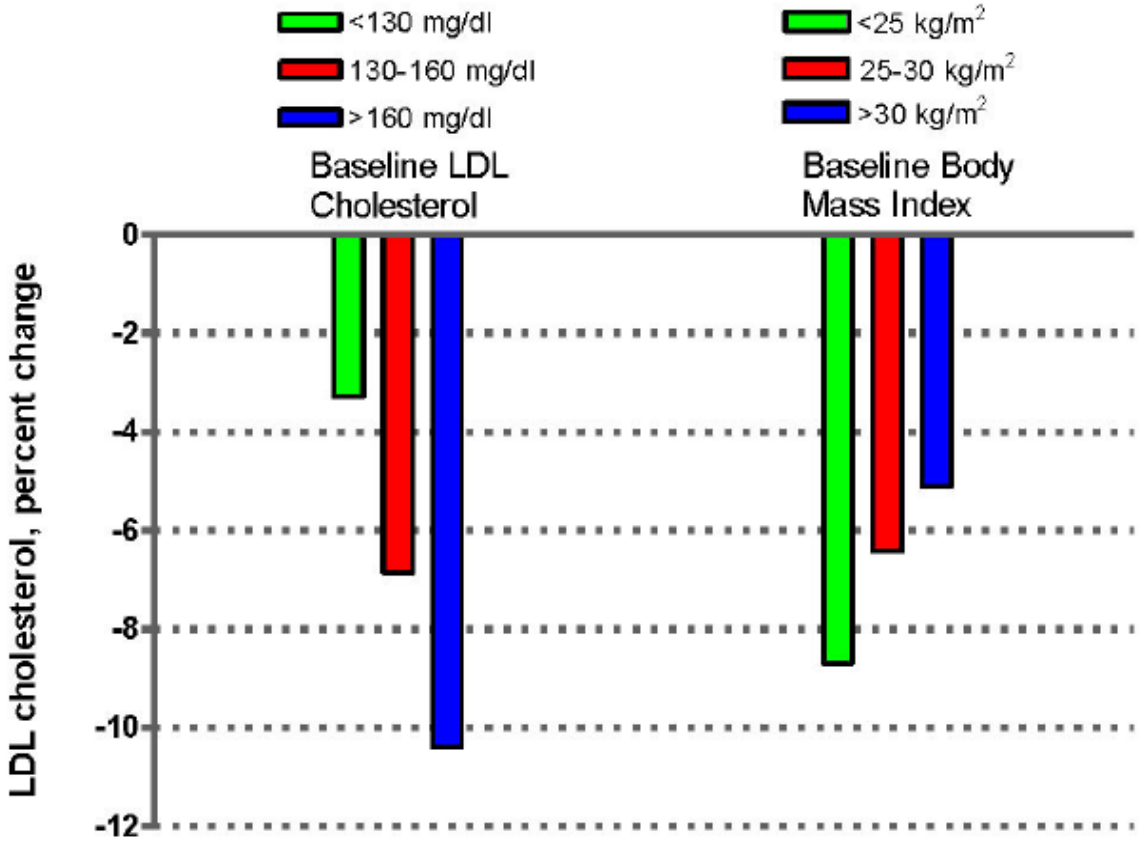
In a 2010 review, Sabaté gave an overview of 25 studies of nut feeding in similar controlled trials involving 583 unique subjects

Average nut feeding was 67 g/d, about 20% of calories

Significant reduction of LDL was seen, on average 10 mg/dl (7%)

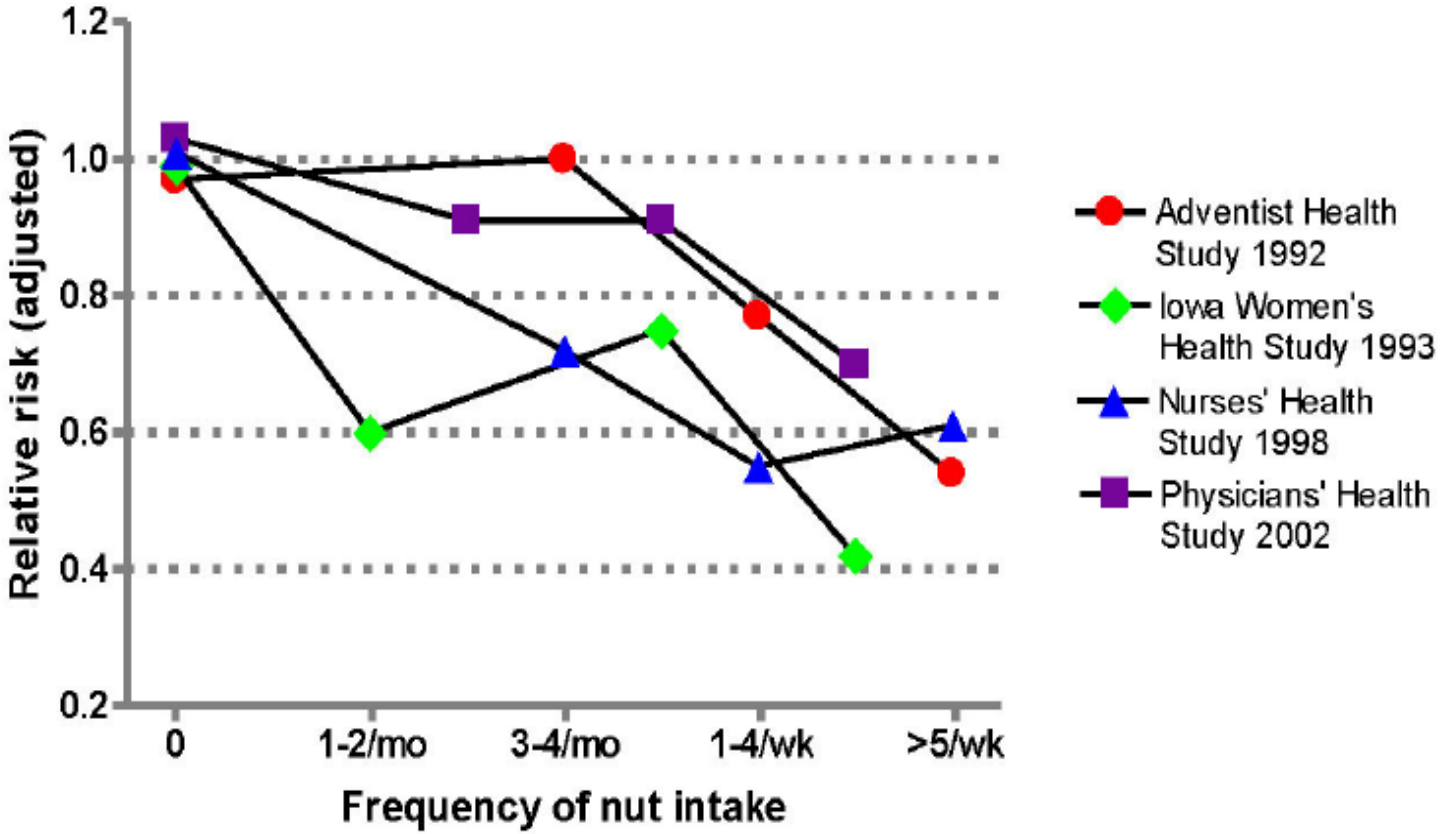
LDL reduction in nut-fed individuals by BMI and LDL

Figure 3. LDL-cholesterol response to nut feeding by baseline LDL-cholesterol level and BMI. Data from a pooled study of 25 nut feeding trials (adapted from ref. 69).



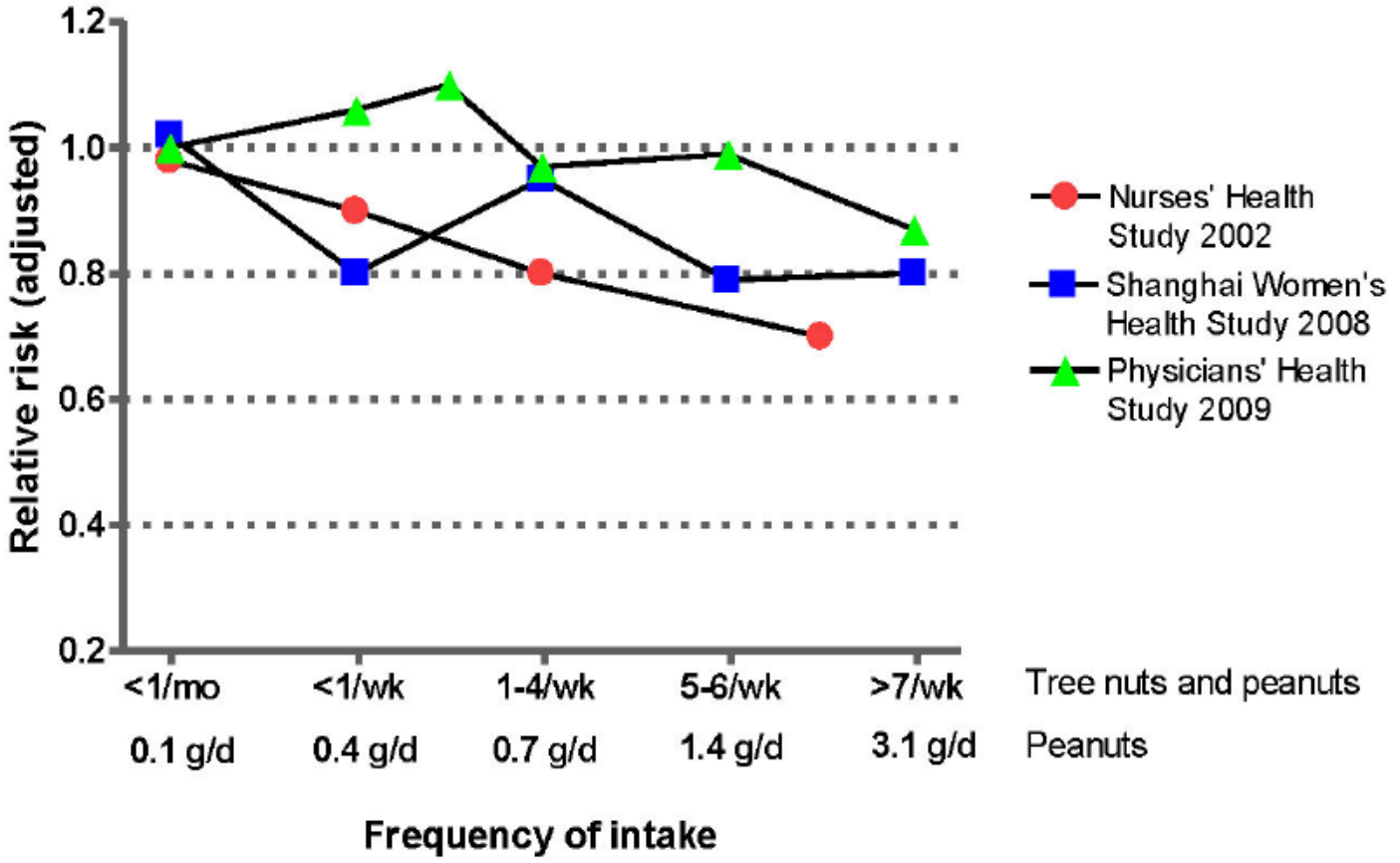
Nut consumption & CHD mortality

Figure 1. Results of prospective studies of nut consumption and risk of death from coronary heart disease.



Nut consumption & diabetes

Figure 2. Results of prospective studies of nut consumption and risk of diabetes. The two US studies considered the frequency of consumption of all nuts, including peanuts, while the Chinese study considered exclusively quintiles of peanut consumption in grams/day.



Nut consumption & mortality

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Association of Nut Consumption with Total and Cause-Specific Mortality

Ying Bao, M.D., Sc.D., Jiali Han, Ph.D., Frank B. Hu, M.D., Ph.D., Edward L. Giovannucci, M.D., Sc.D., Meir J. Stampfer, M.D., Dr.P.H., Walter C. Willett, M.D., Dr.P.H., and Charles S. Fuchs, M.D., M.P.H.

Bao et al – NEJM - 2013

Nut Consumption & mortality

Prospective cohort studies begun in 1980s

- Nurses' Health Study 76,000 women
- Health Professionals Follow-up Study 42,000 men
- 27,000 deaths for analysis
- 30 year follow-up
- Excluded: pre-existing cancer, heart disease or stroke; incomplete data

Nut Consumption & mortality

Methodology – Dietary data

- Food frequency questionaires every 2-4 years
- Nut question split by "peanuts" and "other nuts"
- Serving size: 1 oz.
- Servings: Never, 1-3 / mo, 1 / wk, 2-4 / wk, 5-6 / wk, 1 / d, 2-3 / d, 4-6 / d, >6 / d

Nut Consumption & mortality

Ancillary data

- Smoking history, body mass index (BMI), physical activity, multivitamin use, alcohol intake, aspirin use, frequency of meat, fruit, vegetable consumption, menopausal status, hormone use, personal and family history of diabetes, cancer and heart disease

NHS/HPFS Nut Study: Characteristics

	Nut consumption	
	Never	7+ servings /wk
Smoking (%)	17.3	9.8
Physical activity (mets/wk)	19.2	34.3
Fruit (servings/day)	2.1	2.9
Vegetables (servings/day)	2.4	3.4
Body mass index	26.0	24.9
Alcohol (g/day)	6.0	11.3

Those eating the most nuts were less likely to smoke cigarettes, exercised more, ate more fruit and vegetables, had lower BMI and consumed more alcohol

All are associated with better prognosis

Nut Consumption & mortality

Data Analysis

- Outcomes
  - Total mortality (death from all causes)
  - Specific cause mortality
- Survival analysis – Takes into account the length of time subject lived
- Multiple regression – Takes into account the joint effects of multiple factors

All-cause mortality relative risk vs. nut consumption

	Nuts: Servings per Week					
	0	<1	1	2-4	5-6	7+
RR Unadjusted	1.00	0.72	0.68	0.62	0.65	0.67
RR Adjusted	1.00	0.93	0.89	0.87	0.85	0.80

Increasing nut consumption was strongly associated with lower all-cause mortality

- 33% reduction for habitual consumption vs. never

However, some of this was accounted for by healthier life habits (e.g., less smoking, more exercise)

Even after adjusting for these risk factors, those consuming the most nuts had a 20% lower mortality than those never consuming nuts

Nut Consumption & Mortality

Results – Total Mortality

- Decreasing death rates going from lowest to highest frequencies of nut consumption
- Pattern seen in both men and women
- 20% reduction in death rate for 1+ servings / day compared to those never consuming nuts, after adjustment for all confounding factors

Nut Consumption & Mortality

Results – Specific causes, type of nut

- Grouped into 2+ / wk vs. never
- Women: 18% ate 2+/wk vs. 18% never
- Men: 36% ate 2+/wk vs. 15% never
- Multivariate risk factor adjusted

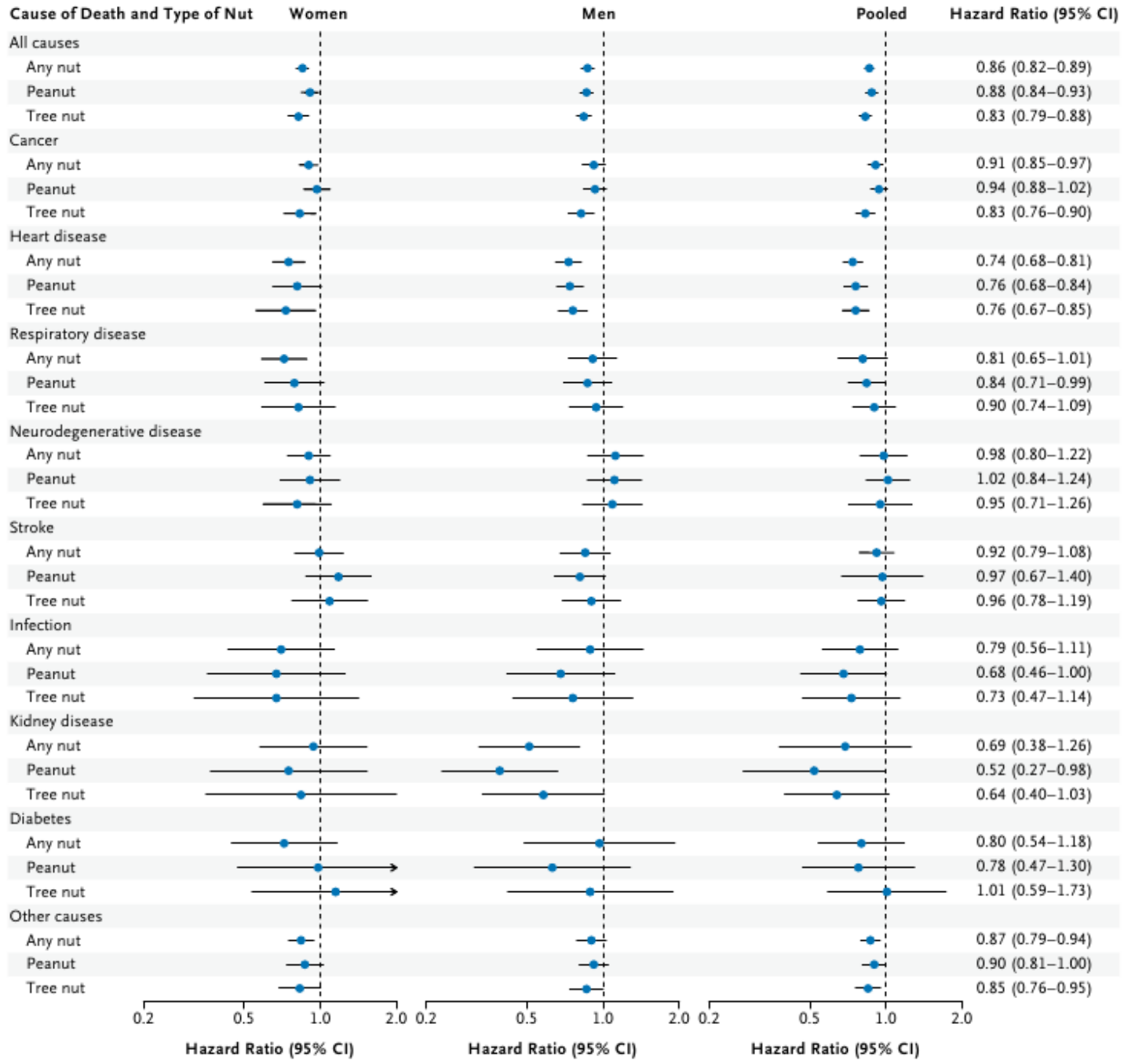


Figure 1. Hazard Ratios for Death from Any Cause and from Specific Causes, According to Frequency of Nut Consumption and Type of Nut.

Nut Consumption & Mortality

Heart disease

- 26% reduction in death rate
- Men = women
- Peanuts = tree nuts

Cancer

- 9% reduction in death rate
- Tree nuts > peanuts

PREDIMED Study - Nuts

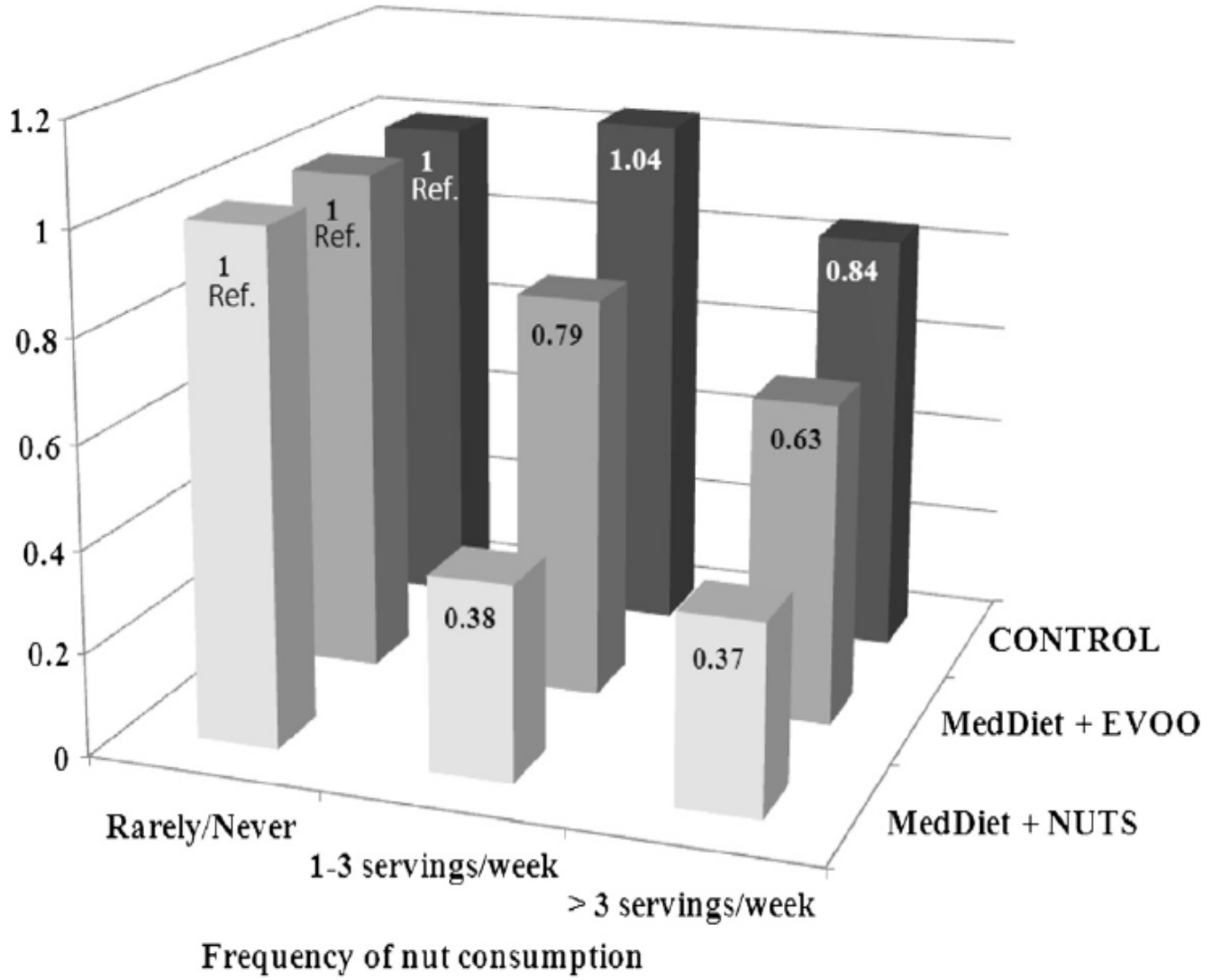


Figure 1 Adjusted hazard ratios of total mortality by frequency of nut consumption and intervention group. The

Nut health benefit - mechanisms

Reduction of LDL cholesterol

- Greater than expected based on saturated fat and cholesterol exchanges with MUFA/PUFA
- Phytosterol may be contributing

Reduction of oxidation

- Tocopherols and phenolic compound effects

Reduction of inflammation

- Some markers improved, remains to be conclusively demonstrated

Reduction of vascular reactivity

- Suggestive evidence, remains to be conclusively demonstrated

Nuts and Health - Concerns

Possible weight gain due to high fat content

- Not observed; some studies show slight weight reduction during nut feeding

Allergies

- May be severe, life-threatening
- Affects about 1% of the population, predicted by other allergic manifestations (asthma, eczema, rhinitis)

Nuts & Health - Summary

Frequent nut consumption is associated with substantial reduction in CHD mortality, which is reflected in a reduction in overall mortality.

Reduction in LDL cholesterol, as seen in feeding trials, may be an important factor in the health benefit of nut consumption.

Other possible mechanisms of benefit include reduction in inflammation, reduction in vascular reactivity and reduction in oxidation, though further work is needed for proof.

Nuts & Health - Summary

Consumption of 1 ounce per day is a reasonable goal, providing about 10% of energy and substantial amount of protein, fiber, phytosterols and other nutrients.

Peanuts, as well as tree nuts, convey benefit. No definite superiority of a specific type of nut has been ascertained.

Weight gain is not seen with substantial nut feeding, and weight reduction has been observed in some settings.

Nut allergy is the main potentially serious adverse effect associated with nut consumption but fortunately is infrequent, about 1% of the population.