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WALNUTS ARE SOMEWHAT DIFFERENT THAN OTHER NUTS

Scientific Testimony to FDA

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Introductory Remarks

I have conducted research on three types of nuts in addition to walnuts (almonds, pecans, peanuts). All showed beneficial health effects. Based on their nutrient composition, all nuts seem far healthier than other high-fat, high-protein foods commonly consumed by Americans.

This brief report focuses on the differences between walnuts and other nuts. Previous reports have already described the favorable benefits of consuming most types of nuts.

NUTRIENT COMPOSITION

Nuts as a food group share several nutritional attributes.

The best known is that they are high in unsaturated fat. Table 1 summarizes the fat content of nuts. By weight, the total fat content of nuts is high, ranging from 45 to 74%, but this fat is largely unsaturated. The ratio of unsaturated to saturated fatty acids, up to 11.9, is extremely high compared to other fatty foods commonly consumed in the American diet. While most nuts are high in monounsaturated fat, ranging from 24 to 82 % of total fat, **walnuts are high in polyunsaturated fatty acids, around 66% (12% α-linolenic, 54% linolenic acids). Walnuts are the highest source of the n-3 α-linolenic acid among all the naturally occurring foods.** Higher concentrations can only be found in extracted oils from flaxseed and soybeans.

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TABLE 1. FAT COMPOSITION OF SEVERAL NUTS

	Total fat (% of weight)	SFA	MUFA	PUFA	PUFA/SFA ratio	UFA/SFA ratio
		(percentage of total fat)				
Almonds	52	10	68	22	2.2	9.0
Brazils	66	26	36	38	1.5	2.8
Cashews	46	20	62	18	0.9	3.9
Hazelnuts	63	8	82	10	1.2	11.9
Macadamias	74	16	82	2	0.1	5.4
Peanuts	49	15	51	34	2.3	5.7
Pecans	68	8	66	26	3.2	10.9
Pinyons	61	15	40	45	2.9	5.4
Pistachios	48	13	72	15	1.2	6.6
Walnuts	**62**	**10**	**24**	**66***	**6.5**	**9.0**

Note: SFA denotes saturated fatty acids; MUFA denotes monunsaturated fatty acids; PUFA denotes polyunsaturated fatty acids. UFA denotes unsaturated fatty acids (MUFA plus PUFA).

* 12% α-linolenic, 54% linolenic acids.

Table created from data in the USDA Handbook No. 8-12.

Besides having a favorable fatty acid profile, nuts are a rich source of nutrients and other bioactive compounds that may favorable influence the risk of coronary heart disease These include tocopherols, dietary fiber, arginine-rich protein, and antioxidant phytochemicals. About one third of a nut's weight is made of substances other than fat. Table 2 is a summary of selected nonfat nutrient components of nuts with antiatherognic properties. **Walnuts are relatively low in α-tocopherol, however, they are a rich source of γ-tocopherol, a lesser known vitamin E component which is increasingly recognized as having antiatherogenic properties** (1). Nuts also contain numerous phytochemicals. Unfortunately there is limited data on phytochemicals in nuts at the present time. Walnuts are high in polyphenolics. In summary, the nutrient composition of walnuts is unique among nuts. **Walnuts are high in PUFA, α-linolenic acid, γ-tocopherol and polyphenolic compound.**

TABLE 2. NONFAT COMPONENTS OF NUTS WITH HYPOTHESIZED ANTIATHEROGENIC PROPERTIES.

	α-tocopherol (mg)	Dietary fiber (g)	Protein (g)	Arginine (g)	Lys/Arg	Mg (mg)	Cu (mg)
Almonds	24.0	11.2	20	2.5	0.3	296	0.9
Brazils	7.6	5.4	14	2.4	0.2	225	1.8
Cashews	0.6	6.0	15	1.7	0.5	260	2.2
Hazelnuts	23.9	6.4	13	2.2	0.2	285	1.5
Macadamias	--	5.2	8	0.9	0.4	116	0.3
Peanuts	9.1	8.8	26	3.5	0.3	180	1.0
Pecans	3.1*	6.5	8	1.1	0.3	128	1.2
Pinyons	--	--	12	2.3	0.2	234	1.0
Pistachios	5.2	10.8	21	2.2	0.6	158	1.2
Walnuts	**2.6***	**4.8**	**14**	**2.1**	**0.2**	**169**	**1.0**

Note: Values per 100 g of edible nut

* Walnuts contain 17.2 mg of γ-tocopherol; pecans contain 19.1 mg.

Source: Based on data from USDA Handbook No. 8-12.

CHOLESTEROL LOWERING EFFECTS OF WALNUTS

Walnuts were the first nut for which the potential cholesterol lowering effects were studied and demonstrated. Ten years ago (2) we found that in a group of healthy men, walnuts had a dramatic serum cholesterol effect beyond what could be predicted by their fatty acid makeup. After my publication in the New England Journal of Medicine in 1993, five other published studies (3-7) and three studies currently in the process of publication have been conducted to specifically study the effect of walnuts on serum lipids. Those studies have been conducted by several research groups, in four continents, with a total of 214 subjects (Table 3). These studies have uniformly demonstrated that a diet enriched with walnuts have a cholesterol lowering effect beyond the effect accomplished by a variety of healthy diets such as the NCEP Step 1 diet, a high-fat Mediterranean diet, or a low-fat Asian diet. Table 4 presents results of my pooled analysis on these eight studies. Compared to the referenced diets, the walnut diet significantly lowers total cholesterol (10.3 mg/dl) and LDL cholesterol (9.8 mg/dl). It also lowers the ratio of LDL to HDL cholesterol and has no significant effect on HDL cholesterol or triglycerides. Very similar results are found when only the six randomized are included in the pool analysis (Table 5).

TABLE 3. SUMMARY OF PUBLISHED WALNUT AND SERUM LIPID STUDIES - DESIGNS AND CHARACTERISTICS.

Ref. / Author / Year	Type of Nut	Where conducted	Subjects	Baseline mean serum cholesterol [Range]	N H *	Study design	Length of diet periods	Design	Comparison Diet	Dietary Control
Sabaté, et al. 1993	Walnuts	California, USA	18 Males	198 mg/dl (5.12 mmol/L)	N	Randomized, controlled crossover feeding trial	Two 4-week dietary periods	R (B-A)	LF (AA)	1
Abbey, et al. 1994	Almonds and Walnuts	Australia	16 Males	199 mg/dl (5.15 mmol/L)	N	Dietary advice, consecutive supplemental field study	Three, 3-week dietary periods One, extra 3 week walnut follow-up	B-A	AA	2
Chisholm, et al. 1998	Walnuts	New Zealand	21 Males	254 mg/dl (6.58 mmol/L)	H	Dietary advice, randomized, crossover clinical study	Two 4-week dietary periods	R	AA	3
Zambón, et al. 2000	Walnuts	Spain	26 Males / 23 Females,	278 mg/dl (7.21 mmol/L)	H	Dietary advice, randomized, crossover clinical study	Two 6-week dietary periods	R (B-A)	MED (LF)	2
Almario, et al. 2001	Walnuts	California, USA	5 Males/13 Females postmenopausal	230 mg/dl (5.97 mmol/L)	N	Dietary advise, consecutive supplemental field study	4 week habitual diet, plus three-6 week dietary periods.	B-A	AA LF	2
Iwamoto, et al 2002	Walnuts	Japan	20 Males/20 Females	M 183 mg/dl (4.75 mmol/L) F 174 mg/dl (4.53 mmol/L)	N	Randomized, controlled crossover feeding trial, single blind	Two 4-week dietary periods	R (B-A)	LF (AA)	1

*N → Noromolipidemic; H → Hyperlipidemic ; D → Diabetic Patients

Design: R → Randomized (Experimental Design) either Parallel or Crossover; B-A → Before After (pre-post)

Comparison Diets: LF → Step 1 (or low fat) (20-30% total fat, <10% SFA, <300 mg cholesterol); AA → Average American – high saturated fat (at many time > 30% total fat, > 10% SFA); MED → Mediterranean (> 30% total fat, <10% SFA, >18%MUFA and/or olive oil/canola oil)

Dietary Control: 1 → Feeding/Metabolic trial; 2 → Dietary Advise, compliance assessment; 3 → No advise or no compliance assessment

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THE ANTIOXIDANT POTENCY OF WALNUTS

A recent report indicates that walnuts have one of the highest contents of antioxidants among edible plants. Halvorsen et al. (8) published data based on a systematic screening of total antioxidants in plant foods using the FRAP assay. Of all foods tested (cereal grains, roots and tubers, vegetables, fruits, berries, legumes, nuts) walnut extracts showed the highest total antioxidant concentrations with the exception of a berry called "dog rose." Also, total antioxidants in walnuts were many-fold higher than any other nut. (Table 6.) It is not surprising that Anderson et al. (9) found that walnut polyphenol-rich extracts inhibited in vitro plasma and LDL oxidation by 38% and 84% respectively.

In spite of its high polyunsaturated fatty acid content, a diet high in walnuts seems to preserve the resistance of LDL-cholesterol particles to in vitro oxidation. Two recent walnut trials have shown that levels of oxidized LDL were similar for the walnut diet and control Mediterranean (5) or Japanese (6) diets.

In addition to polyphenolics, another strong antioxidant that is particularly abundant in walnuts is γ-tocopherol. A recent clinical trial found that daily consumption of about 2 oz of walnuts for four weeks increased by two-fold, serum levels of γ-tocopherol and preserved the serum levels of α-tocopherol (16). While γ-tocopherol has been investigated much less than α-tocopherol, it is increasingly recognized as a relevant antiatherogenic molecule (1). Furthermore, this recent clinical trial (16) indicates that walnut consumption is not associated with lipid peroxidation.

α-LINOLENIC ACID INTAKE AND CORONARY RISK

Randomized dietary intervention trials have reported a markedly reduced risk of recurrent events in cardiac death in patients assigned to a diet including either nuts or high in α-linolenic acid (10, 11). Small to moderate amounts of n-3 fatty acids have been demonstrated to have antiarrhythmic effects and to prevent sudden cardiac death in patients who have had a myocardial infarction (12, 13). Also, dietary intake of α-linolenic acid prevents primary events of coronary heart disease (14). The importance of an adequate intake of α-linolenic acid for good health is such that The Institute of Medicine of the National Academies of Sciences has recently issued dietary reference intakes (DRI) for this essential fatty acid. The DRI for males is 1.6 g/day and for females 1.1 g/day (15). One ounce of walnuts (28 grams) contains 2.5 grams of α-linolenic acid. Thus, half an ounce of walnuts can meet the DRI for this essential nutrient.

TABLE 6 Total antioxidant concentrations of nuts and seeds[1] *

Nuts and seeds	Botanical name	Family	Sample A	*nmol/ 100 g*	Sample B	*nmol/ 100 g*	Sample C	*nmol/ 100 g*	Overall mean
Walnut	**Juglans regia**	**Juglandaceae**	**Diamond (*n* = 3)[2]**	**17.89**	**Helios (*n* = 3)**	**19.76**	**Helios (*n* = 3)**	**25.25**	**20.97**
Sunflower seed	Helianthus annuus	Asteraceae	Natuvit, Danmark (*n* = 3)	5.41	Natuvit, Danmark (*n* = 3)	4.57	Natuvit, Danmark (*n* = 3)	6.18	5.39
Sesame seed	Sesamum indicum	Pedaliaceae	Natana, Danmark (*n* = 3)	1.09	Natana, Danmark (*n* = 3)	1.25	Natana, Danmark (*n* = 3)	1.28	1.21
Hazelnut	Corylus avellana	Betulaceae	Nøttefabrikken (*n* = 3)	0.48	Solbætorvet (*n* = 3)	0.50	Nøttefabrikken (*n* = 3)	0.49	0.49
Almond	Prunus mygdalus	Rosaceae	Solbætorvet (*n* = 3)	0.44	ICA, Norway (*n* = 3)	0.23	Meny, Norway (*n* = 3)	0.23	0.30
Cashew nut	Anacardium occidentale	Anarcadiaceae	Nøttefabrikken (*n* = 3)	0.22	Nøttefabrikken (*n* = 3)	0.23	Nøttefabrikken (*n* = 3)	0.24	0.23

[1] Electron-donating antioxidants were determined by the FRAP assay. Values represent mean concentration per 100 g fresh weight of edible portion if not otherwise stated. The origin, brand and cultivar are indicated for each sample, if available. Samples A, B and C represent separate samples of the same dietary plant obtained from different sources such as geographical location or manufacturer.

[2] The number of items analyzed is indicated in parentheses.

* Taken from Halvorsen , et al (8).

EFFECTS OF WALNUTS ON OTHER CORONARY RISK FACTORS

Walnut intake may also reduce coronary risk by reversing endothelial dysfunction and improving vasomotor function. This is the main finding of an unpublished study recently conducted in Barcelona and mentioned earlier in this report (16). Twenty-one hypercholesterolemic men and women followed a cholesterol-lowering Mediterranean diet and a diet of similar energy and fat content in which walnuts replaced approximately 32% of energy from olive oil. Compared with the Mediterranean diet the walnut diet improved brachial artery endothelium-dependent vasodilatation and reduced levels of vascular cell adhesion molecule-1. This finding might explain the cardio protective effect of walnut intake beyond cholesterol lowering and antioxidant capacity.

SUMMARY

The unique nutrient composition of walnuts sets this nut apart from the others. Many clinical trials on normal and hyperlipidemic individuals using several healthy diets as reference showed the cholesterol lowering properties of walnuts. This effect is somewhat greater than that exercised by other nuts. Walnuts have a powerful antioxidant effect in vitro, much higher than other nuts and seeds, and there is indication that this effect is translated also in vivo. The high content of the essential fatty acid α-linolenic in walnuts seems important in its own right in coronary risk prevention. Also, walnut intake may reduce coronary risk by improving endothelial function, something not yet tested in other nuts. Therefore, I am convinced there is enough evidence to assert that diets including walnuts on a regular basis reduce the risk of coronary heart disease. Thus, it seems a good public health policy to recommend the inclusion of walnuts to any diet without exceeding energy needs.

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While preparing this document, it occurs to me that the FDA has a track record of approving health claims for specific foods apart from their food group. Soy protein has a specific claim that does not encompass other legumes. Also the FDA approved a health claim for oats and this does not include all cereal grains. The FDA approval of a health claim for walnuts independent of other nuts would not be without precedent.

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