Essential fatty acids in the vegan/total vegetarian diet

People choose vegetarian/vegan diets and for many reasons, however, these diets require careful dietary planning. The essential polyunsaturated n-6 (omega-6) and n-3 (omega-3) fatty acids are required for synthesis of inflammatory compounds, cell membranes, skin, brain and nerve tissues, vision, as well as reproduction, and must be provided by the diet. Linoleic (LA) and arachidonic acids (AA) are classified as n-6 fatty acids, and alpha-linolenic (ALA), eicosapentaenoic (EPA) and docosahexaenoic acids (DHA) are n-3 fatty acids. EPA and DHA are not considered to be essential since they can be converted in the body from ALA; however, they may be of concern for vegans/strict/ total vegetarians (VGNs), since VGN diets are typically absent of EPA and DHA. Good sources of the long-chain n-3 fatty acids, EPA and DHA are primarily animal-origin foods, and typically, US omnivores obtain enough dietary EPA and DHA. But unless VGNs consume algal n-3 supplements, their bodies rely on internal production of EPA and DHA from LA.

Both LA and ALA use the same enzyme system to convert LA to AA and ALA to EPA and DHA, therefore, high body levels of LA or low ALA levels decrease ALA conversion to EPA and DHA. VGNs have high dietary intakes of LA (n-6) as compared to omnivore diets. Most humans, except those with inborn errors of metabolism, can modestly (5%-8%) convert ALA to EPA and/or DHA, and LA to AA. EPA and DHA algal supplements may be needed for those individuals with increased need such as lactating and or pregnant VGNs, or those lacking the conversion enzymes due to an inborn error of metabolism.

The Dietary Reference Intakes (DRIs) for the n-6 AI requirement range is 12–11 g/day for men and 17–14 g/day for adult women (non-pregnant/lactating), and the AI n-3 fatty acid recommendations are 1.1 g/day of ALA for women and 1.6 g/day for men. Food sources of ALA and LA commonly consumed by US VGNs can be seen in Table 1.

The most abundant n-3 fatty acid is ALA. It is found in flaxseed (linseed), English walnut, hemp seed, and chia. The major dietary plant-based sources of LA and ALA are typically found together, and it is very difficult to obtain ALA without also increasing the amount of LA in the diet, unless specific foods high in ALA are consumed (Table 1).

Nutrient	Energy	Protein	Total Lipid	18:2n-6	18:3n-3	CHO	Total Fiber
	Kcal	g	g	g	g	g	g
Oils[2]							
Oil, Canola	884	0	100	18.64	9.137	0	0
Oil, Flaxseed/Linseed (Panos)	884	0.11	100	14.25	53.37	0	0
Oil, Soybean	763	0	100	50.42	6.789	0	0
Oil, Walnut	884	0	100	52.90	10.40	0	0
Oil, High Oleic Sunflower	884	0	100	3.61	0.192	0	0
Oil, High Oleic Safflower	884	0	100	12.72	0.096	0	0
Oil, Culinary Algae	800	0	93	n/a	n/a	0	0
Ovega-3	n/a	0	n/a	n/a	0.5	0	0
Deva Vegan	5	0	0.5	n/a	0.2	0	0
Nordic Naturals	10.0	0	1.00	n/a	0.715	0	0
Food Sources							
Almonds Raw	579	21.2	50	12.3	0.00	21.6	12.50
Amaranth	371	13.7	7.02	2.74	0.04	65.3	6.70
Avocados, Raw, California	167	1.96	15.4	1.67	0.11	8.64	6.80
Black Walnuts Dried	619	24.1	59.3	33.8	2.68	9.58	6.80
Brazil Nuts, Dried	659	14.3	67.1	23.9	0.02	11.7	7.50
Brown Rice Cooked	123	2.74	0.97	0.36	0.01	25.6	1.60
Bulgur Cooked	83	3.08	0.24	0.09	0.00	18.6	4.50
Cashews Raw	553	18.2	43.9	7.78	0.06	30.2	3.30
Chia Seeds Dried	486	16.5	30.7	5.84	17.8	42.1	34.4
English Walnuts Dried	654	15.2	65.2	38.1	9.08	13.7	6.70
Flaxseed Raw	534	18.3	42.2	5.90	22.8	28.9	27.3
Hempseed Hulled	553	31.6	48.8	1.34	8.86	8.67	4.00
Millet Cooked	119	3.51	1.00	0.48	0.03	23.7	1.300
Oat Bran Cooked	40	3.21	0.86	0.32	0.02	11.4	2.60
Pistachio Raw	560	20.2	45.3	13.1	0.21	27.2	10.60
Poppy Seeds	525	18.0	41.6	28.3	0.27	28.1	19.50
Quinoa	368	14.1	6.07	2.98	0.26	64.2	7.00
Rye	338	10.3	1.63	0.66	0.11	75.9	15.1
Sesame Seeds dried	573	17.7	49.7	21.4	0.38	23.5	11.8
Soybeans Raw	446	36.5	19.9	9.93	1.33	30.2	9.30
Soybeans, Boiled	141	12.4	6.40	2.66	0.35	11.1	4.20
Sunflower Seeds	584	20.8	51.5	23.1	0.10	20.0	8.60

Tab. 1. Energy, protein, total lipid, 18:2 n-6, 18:3 n-3, carbohydrate, and fiber contents of oils and foods commonly consumed by vegans for the essential fatty acids. Modified from Burns-Whitmore and Froyen doi.org/10.3390/nu11102365

The recommendations for n-6:n-3 ratios suggested by experts and researchers, is in the range of 2-4:1. Some suggest an increase of ALA and a decrease of LA to meet the ratio or index. Decreasing LA in the diet might be the best option if the VGN is overconsuming LA (more than 1–2% total dietary Kcals). Some researchers suggest that the recommendation for ALA be increased to 1.1 g/1000 Kcal or >1% of energy/2000 Kcals for VGNs, which may ensure intakes of at least 2.2 g/day and up to 4.4 g/day of ALA, to meet the 4:1 ratio. However, before decreasing dietary LA or increasing ALA, it is important to determine dietary intake of LA and ALA in the diet to decide whether ALA should be increased or LA decreased. Trained health professionals and Registered Dietitian Nutritionists can assist by using computer applications along with comprehensive client/patient diet records. The authors suggest that adult VGNs consume between 2.2–4.4 g/g of ALA d (or 1.1 g/day/1000 Kcals) and decrease unnecessary or high sources of LA (greater than the AI) in the VGN diet, especially if they consume a 10:1 ratio of n-6:n-3, and/or levels greater than the AI for LA.

Bonny Burns-Whitmore, Erik Froyen
Department of Nutrition and Food Science California State Polytechnic University, Pomona, USA

Publication

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