Vegetarian Diets – American Dietetic Association

The New Zealand Dietetic Association (NZDA) has adopted and endorsed the position paper of the American Dietetic Association (ADA) – "Vegetarian Diets", published in the Journal of the American Dietetic Association 1997; 97: 1317–21. The endorsement is subject to a number of recommendations which should be read, as annotated, using circled/highlighted numbers in the text of the ADA Position Paper on Vegetarian Diets. These recommendations are found following the ADA Position Paper.

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VEGETARIAN DIETS – ADA POSITION PAPER

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Scientific data suggest positive relationships between a vegetarian diet and reduced risk for several chronic degenerative diseases and conditions, including obesity, coronary artery disease, hypertension, diabetes mellitus, and some types of cancer. Vegetarian diets, like all diets, need to be planned appropriately to be nutritionally adequate.

● POSITION STATEMENT

It is the position of The American Dietetic Association (ADA) that appropriately planned vegetarian diets are healthful, are nutritionally adequate, and provide health benefits in the prevention and treatment of certain diseases.

Vegetarianism in perspective

The eating patterns of vegetarians vary considerably. The lacto-ovo-vegetarian eating pattern is based on grains, vegetables, fruits, legumes, seeds, nuts, dairy products, and eggs, and excludes meat, fish, and fowl. The vegan, or total vegetarian, eating pattern is similar to the lacto-ovo-vegetarian pattern except for the additional exclusion of eggs, dairy, and other animal products. Even within these patterns, considerable variation may exist in the extent to which animal products are avoided. Therefore, individual assessment is required to accurately evaluate the nutritional quality of a vegetarian's dietary intake.

Studies indicate that vegetarians often have lower morbidity (1) and mortality (2) rates from several chronic degenerative diseases than do non-vegetarians. Although non-dietary factors, including physical activity and abstinence from smoking and alcohol, may play a role, diet is clearly a contributing factor.

In addition to the health advantages, other considerations that may lead a person to adopt a vegetarian diet pattern include concern for the environment, ecology, and world hunger issues. Vegetarians also cite economic reasons, ethical considerations, and religious beliefs as their reasons for following this type of diet pattern. Consumer demand for vegetarian options has resulted in increasing numbers of foodservices that offer vegetarian options. Presently, most university foodservices offer vegetarian options.

Health implications of vegetarianism

Vegetarian diets low in fat or saturated fat have been used successfully as part of comprehensive health programs to reverse severe coronary artery disease (3,4). Vegetarian diets offer disease protection benefits because of their lower saturated fat, cholesterol, and animal protein content and often higher concentration of folate (which reduces serum homocysteine levels) (5), antioxidants such as vitamins C and E, carotenoids, and phytochemicals (6). ❶Not only is mortality from coronary artery disease lower in vegetarians than in non-vegetarians (7), but vegetarian diets have also been successful in arresting coronary artery disease (8,9). Total serum cholesterol and low-density lipoprotein cholesterol levels are usually lower in vegetarians, but high-density lipoprotein cholesterol and triglyceride levels vary depending on the type of vegetarian diet followed (10).

Vegetarians tend to have a lower incidence of hypertension than non-vegetarians (11). This effect appears to be independent of both body weight and sodium intake. Type 2 diabetes mellitus is much less likely to be a cause of death in vegetarians than non-vegetarians, perhaps because of their higher intake of complex carbohydrates and lower body mass index (12).

Incidence of lung and colorectal cancer is lower in vegetarians than in non-vegetarians (2,13). Reduced colorectal cancer risk is associated with increased consumption of fiber, vegetables, and fruit (14,15). The environment of the colon differs notably in vegetarians compared with non-vegetarians in ways that could favourably affect colon cancer risk (16,17). Lower breast cancer rates have not been observed in Western vegetarians, but cross-cultural data indicate that breast cancer rates are lower in populations that consume plant-based diets (18). The lower estrogen levels in vegetarian women may be protective (19).

A well-planned vegetarian diet may be useful in the prevention and treatment of renal disease. Studies using human being and animal models suggest that some plant proteins may increase survival rates and decrease proteinuria, glomerular filtration rate, renal blood flow, and histologic renal damage compared with a non-vegetarian diet (20,21).

Nutrition considerations for vegetarians

Plant sources of protein alone can provide adequate amounts of essential amino acids if a variety of plant foods are consumed and energy needs are met. Research suggests that complementary proteins do not need to be consumed at the same time and that consumption of various sources of amino acids over the course of the day should ensure adequate nitrogen retention and use in healthy persons (22). Although vegetarian diets are lower in total protein and a vegetarian's protein needs may be somewhat elevated because of the lower quality of some plant proteins, protein intake in both lacto-ovo-vegetarians and vegans appears to be adequate (16).

Plant foods contain only non-heme iron, which is more sensitive than heme iron to both inhibitors and enhancers of iron absorption. Although vegetarian diets are higher in total iron content than non-vegetarian diets, iron stores are lower in vegetarians because the iron from plant foods is more poorly absorbed (23). The clinical importance of this, if any, is unclear because iron deficiency anemia rates are similar in vegetarians and non-vegetarians (23). The higher vitamin C content of vegetarian diets may improve iron absorption.

Although plant foods can contain vitamin B-12 on their surface from soil residues, this is not a reliable source of B-12 for vegetarians. Much of the vitamin B-12 present in spirulina, sea vegetables, tempeh and miso has been shown to be inactive B-12 analog rather than the active vitamin. Although dairy products and eggs contain vitamin B-12, research suggests that lacto-ovo-vegetarians have low blood levels of vitamin B-12. Supplementation or use of fortified foods is advised for vegetarians who avoid or limit animal foods (24).

Because vitamin B-12 requirements are small, and it is both stored and recycled in the body, symptoms of deficiency may be delayed for years. Absorption of vitamin B-12 becomes less efficient as the body ages, so supplements may be advised for all older vegetarians.

Lacto-ovo-vegetarians have calcium intakes that are comparable to, or higher than, those of non-vegetarians (25,26). Calcium intakes of vegans, however, are generally lower than those of both lacto-ovo-vegetarians and omnivores (26). It should be noted that vegans may have lower calcium needs than non-vegetarians, because diets that are low in total protein, and more alkaline, have been shown to have a calcium-sparing effect (27). Furthermore, when a person's diet is low in both protein and sodium and regular weight-bearing physical activity is engaged in, his or her calcium requirements may be lower than those of a sedentary person who eats a standard Western diet. These factors, and genetic influences, may help explain variations in bone health that are independent of calcium intake.

Because calcium requirements of vegans have not been established and inadequate calcium intakes are linked to risk for osteoporosis in all women, vegans should meet the calcium requirements established for their age group by the Institute of Medicine (28). Calcium is well absorbed from many plant foods, and vegan diets can provide adequate calcium if the diet regularly includes foods rich in calcium (29). In addition, many new vegetarian foods are calcium-fortified. Dietary supplements are advised for vegans only if they do not meet calcium requirements from food.

Vitamin D is poorly supplied in all diets unless vitamin D-fortified foods are consumed. Vegan diets may lack this nutrient because fortified cows' milk is its most common dietary source. However, vegan foods supplemented with vitamin D, such as soymilk and some cereals, are available. Furthermore, findings indicate that sunlight exposure is a major factor affecting vitamin D status, and that dietary intake is important only when sun exposure is inadequate (30). Sun exposure to hands, arms, and face for five to 15 minutes per day is believed to be adequate to provide sufficient amounts of vitamin D (31). People with dark skin, or those who live at northern latitudes or in cloudy or smoggy areas, may need increased exposure. Use of sunscreen interferes with vitamin D synthesis. If sun exposure is inadequate, vitamin D supplements are recommended for vegans. This is especially true for older persons who synthesize vitamin D less efficiently and who may have less sun exposure.❷

Studies show zinc intake to be lower, or comparable, in vegetarians compared with non-vegetarians (16). Most studies show that zinc levels in hair, serum, and saliva are in the normal range in vegetarians (32). Compensatory mechanisms may help vegetarians adapt to diets that may be low in zinc (33). However, because of the low bioavailability of zinc from plant foods, and because the effects of marginal zinc status are poorly understood, vegetarians should strive to meet or exceed the recommended dietary allowances for zinc.

Diets that do not include fish or eggs lack the long-chain n-3 fatty acid docosahexanoic acid (DHA). Vegetarians may have lower blood levels of this fatty acid, although not all studies are in agreement with this finding (34,35). The essential fatty acid, linolenic acid can be converted to DHA, although conversion rates appear to be inefficient and high intakes of linoleic acid interfere with conversion (36). The implications of low levels of DHA is not clear. However, it is recommended that vegetarians include good sources of linolenic acid in their diet.❸

Figure 1 presents food sources of nutrients that are often of concern for vegetarians.❹

Vegetarianism throughout the life cycle

Well-planned vegan and lacto-ovo-vegetarian diets are appropriate for all stages of the life cycle, including during pregnancy and lactation. Appropriately planned vegan and lacto-ovo-vegetarian diets satisfy nutrient needs of infants, children and adolescents, and promote normal growth (37). Dietary deficiencies are most likely to be observed in populations with very restrictive diets. All vegan children should have a reliable source of vitamin B-12 and, if sun exposure is limited, vitamin D supplements or fortified foods should be used. Foods rich in calcium, iron, and zinc should be emphasized. Frequent meals and

Figure 1:

Iron	Milligrams per serving
Breads, cereals, and grains	
Whole wheat bread, 1 slice	0.9
White bread, 1 slice	0.7
Bran flakes, 1 c	11.0
Cream of wheat, 1/2 c cooked	5.5
Oatmeal, instant, 1 packet	6.3
Wheat germ, 2 Tbsp	1.2
Vegetables (1/2 c cooked)	
Beet greens	1.4
Sea vegetables	18.1–42.0
Swiss chard	1.9
Tomato juice, 1 c	1.3
Turnip greens	1.5
Legumes (1/2 c cooked)	
Baked beans, vegetarian	0.74
Black beans	1.8
Garbanzo beans	3.4
Kidney beans	1.5
Lentils	3.2
Lima beans	2.2
Navy beans	2.5
Soyfoods (1/2 c cooked)	
Soybeans	4.4
Tempeh	1.8
Tofu	6.6
Soymilk, 1 c	1.8
Nuts/seeds (2 Tbsp)	
Cashews	1.0
Pumpkin seeds	2.5
Tahini	1.2
Sunflower seeds	1.2
Other foods	
Blackstrap molasses, 1 Tbsp	3.3

Calcium	Milligrams per serving
Legumes (1 c cooked)	
Chickpeas	78
Great northern beans	121
Navy beans	128
Pinto beans	82
Black beans	103
Vegetarian baked beans	128
Soyfoods	
Soybeans, 1 c cooked	175
Tofu, 1/2 c	120–350
Tempeh, 1/2 c	77
Textured vegetable protein, 1/2 c	85
Soymilk, 1 c	84
Soymilk, fortified, 1 c	250–300
Soynuts, 1/2 c	252
Nuts and seeds (2 Tbsp)	
Almonds	50
Almond butter	86
Vegetables (1/2 c cooked)	
Bok choy	79
Broccoli	89
Collard greens	178
Kale	90
Mustard greens	75
Turnip greens	125
Fruits	
Dried figs, 5	258
Calcium-fortified orange juice, 1 c	300
Other Foods	
Blackstrap molasses, 1 Tbsp	187
Cow's milk, 1 c	300
Yogurt, 1 c	275–400

Zinc	Milligrams per serving
Breads, grains, and cereals	
Bran flakes, 1 c	5.0
Wheat germ, 2 Tbsp	2.3
Legumes (1/2 c cooked)	
Adzuki beans	2.0
Chickpeas	1.3
Lima beans	1.0
Lentils	1.2
Soyfoods (1/2 c cooked)	
Soybeans	1.0
Tempeh	1.5
Tofu	1.0
Textured vegetable protein	1.4
Vegetables (1/2 c cooked)	
Corn	0.9
Peas	1.0
Sea vegetables	1.1–2.0
Dairy foods	
Cow's milk, 1 c	1.0
Cheddar cheese, 1 oz	0.9
Yogurt, 1 c	1.8

Vitamin D	Micrograms per serving
Fortified, ready-to-eat cereals, 3/4 c	1.0–2.5
Fortified soymilk or other non-dairy milk, 1 c	1.0–2.5

Vitamin B-12	Micrograms per serving
Ready-to-eat breakfast cereals, 3/4 c	1.5–6.0
Meat analogs (1 burger or 1 serving according to package)	2.0–7.0
Fortified soymilk or other non-dairy milks, 8 oz	0.2–5.0
Nutritional yeast (Red Star Vegetarian Support Formula, formerly T6635[a]), 1 Tbsp	4.0

Linolenic acid	Grams per serving
Flax seed, 2 Tbsp	4.3
Walnuts, 1 oz	1.9
Walnut oil, 1 Tbsp	1.5
Canola oil, 1 Tbsp	1.6
Linseed oil, 1 Tbsp	7.6
Soybean oil, 1 Tbsp	0.9
Soybeans, 1/2 c cooked	0.5
Tofu, 1/2 c	0.4

FIG 1. Food sources of nutrients. Sources: Package information and data from: Pennington J. Bowe's and Church's Food Values of Portions Commonly Used. *16th ed. Lippincott-Raven; 1994.* Provisional Table on the Content of Omega-3 Fatty Acids and Other Fat Components in Selected Foods, 1988. *Washington, DC: US Dept of Agriculture: 1988: Publication No. HNIS/PT-103. Hytowitz DB, Matthews RH.* Composition of Foods: Legumes and Legume Products. *Washington, DC: US Dept of Agriculture; 1986. Agriculture Handbook No. 8–16.*

[a] *Red Star Yeast and Products, a division of Universal Foods Corp, Milwaukee, Wisc.*

snacks, and the use of some refined foods and foods higher in fat can help vegetarian children meet energy needs. Guidelines for iron and vitamin D supplements and for the introduction of solid foods are the same for vegetarian and non-vegetarian infants. When it is time for protein-rich foods to be introduced, vegetarian infants can have pureed tofu, cottage cheese, and legumes (pureed and strained). Breast-fed vegan infants should receive a source of vitamin B-12 if the mother's diet is not supplemented and a source of vitamin D if sun exposure is inadequate.❺

Vegetarian diets are somewhat more common among adolescents with eating disorders than in the general adolescent population; therefore, dietetics professionals should be aware of young clients who greatly limit food choices and who exhibit symptoms of eating disorders (38). However, recent data suggests that adopting a vegetarian diet does not lead to eating disorders (39). With guidance in meal planning, vegetarian diets are appropriate and healthful choices for adolescents.

Vegetarian diets can also meet the needs of competitive athletes. Protein needs may be elevated because training increases amino acid metabolism, but vegetarian diets that meet energy needs and include good sources of protein (e.g. soyfoods, legumes) can provide adequate protein without use of special foods or supplements. For adolescent athletes, special attention should be given to meeting energy, protein, and iron needs. Amenorrhea may be more common among vegetarian than non-vegetarian athletes, although not all research supports this finding (40,41). Efforts to maintain normal menstrual cycles might include increasing energy and fat intake, reducing fiber, and reducing strenuous training.

Lacto-ovo-vegetarian and vegan diets can meet the nutrient and energy needs of pregnant women. Birth weights of infants born to well nourished vegetarian women have been shown to be similar to birth-weight norms and to birth weights of infants of non-vegetarians (42). Diets of pregnant and lactating vegans should be supplemented with 2.0 micrograms and 2.6 micrograms, respectively, of vitamin B-12 daily and, if sun exposure is limited, with 10 micrograms vitamin D daily (43,44). Supplements of folate are advised for all pregnant women, although vegetarian women typically have higher intakes than non-vegetarians.❻

Meal planning for vegetarian diets

A variety of menu-planning approaches can provide vegetarians with adequate nutrition. Figure 2 suggests one approach.❼ In addition, the following guidelines can help vegetarians plan healthful diets.

- ➢ Choose a variety of foods, including whole grains, vegetables, fruits, legumes, nuts, seeds and, if desired, dairy products and eggs.
- ➢ Choose whole, unrefined foods often and minimize intake of highly sweetened, fatty, and heavily refined foods.
- ➢ Choose a variety of fruits and vegetables.
- ➢ If animal foods, such as dairy products and eggs, are used, choose lower-fat versions of these foods. Cheeses and other high-fat dairy foods and eggs should be limited in the diet because of their saturated fat content, and because their frequent use displaces plant foods in some vegetarian diets.
- ➢ Vegans should include a regular source of vitamin B-12 in their diets along with a source of vitamin D if sun exposure is limited.
- ➢ Solely breast-fed infants should have supplements of iron after the age of four to six months and, if sun exposure is limited, a source of vitamin D. Breast-fed vegan infants should have vitamin B-12 supplements if the mother's diet is not fortified.
- ➢ Do not restrict dietary fat in children younger than two years. For older children, include some foods higher in unsaturated fats (eg, nuts, seeds, nut and seed butters, avocado, and vegetable oils) to help meet nutrient and energy needs.❽

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Figure 2: **Food guide pyramid for vegetarian meal planning**

FATS, OILS, AND SWEETS
— use sparingly
candy, butter, margarine,
salad dressing, cooking oil

MILK, YOGURT, AND CHEESE GROUP
0–3 servings daily*
milk—1 cup
yogurt—1 cup
natural cheese—1 1/2 oz
*Vegetarians who choose not to use milk, yogurt, or cheese need to select other food sources rich in calcium. For a list of calcium-rich foods, please see Figure 1.

DRY BEANS, NUTS, SEEDS, EGGS, AND MEAT SUBSTITUTES GROUP
2–3 servings daily
soy milk—1 cup
cooked dry beans or peas—1/2 cup
1 egg or 2 egg whites
nuts or seeds—2 Tbsp
tofu or tempeh—1/4 cup
peanut butter—2 Tbsp

VEGETABLE GROUP
3–5 servings daily
cooked or chopped raw
vegetables—1/2 cup
raw leafy vegetables—1 cup

FRUIT GROUP
2–4 servings daily
juice—3/4 cup
dried fruit—1/4 cup
chopped, raw fruit—1/2 cup
canned fruit—1/2 cup
1 medium-size piece of fruit, such as banana, apple, or orange

BREAD, CEREAL, RICE, AND PASTA GROUP
6-11 servings daily
bread—1 slice
ready-to-eat—1 oz
cooked cereal—1/2 cup
cooked rice, pasta, or other grains—1/2 cup
bagel—1/2

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ADA Position adopted by the House of Delegates on October 18, 1987, and reaffirmed on September 12, 1992, and September 6, 1996. This position will be in effect until December 31, 2001. ADA authorizes republication of the position statement/support paper, in its entirety, provided full and proper credit is given. Requests to use portions of the position must be directed to ADA Headquarters at 800/877-1600, ext 4896, or hod@eatright.org. Recognition is given to the following for their contributions:

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NEW ZEALAND DIETETIC ASSOCIATION RECOMMENDATIONS

❶ Recent studies have shown that a high folate intake, in combination with a low vitamin B-12 intake (such as in people following strict vegan diets), may lead to higher plasma homocysteine levels (1), thus being less protective for cardiovascular disease. A high folate intake alone may not guarantee low plasma homocysteine levels in all vegetarian diets. Vegetarians often have high intakes of folate and vitamin B-6 however, that are related to low blood homocysteine levels in those with adequate vitamin B-12 intakes.(2)

❷ The Cancer Society of New Zealand recommends that about 30 minutes of daily exposure to sunlight is sufficient for most New Zealanders to synthesise the vitamin D they need. During the daylight saving months, when levels of ultra-violet radiation (UVR) are dangerously high, most of this exposure should be outside the peak UVR hours of 11 am to 4 pm. Some combination of shade, clothing, hats and sunscreen should be used for protection during peak UVR hours.

❸ Long chain fatty acid (LCFA) requirements in vegetarians.

Vegetarians who do not consume fish are dependent on plant sources of omega-3 long chain poly-unsaturated fatty acids (LCPUFA), such as eicosa-pentaenoic acid (EPA) and docosahexanoic acid (DHA). These LCPUFA are required in the body for the normal development of the retina and central nervous system (3,4).

Long chain omega-3 polyunsaturated fatty acids can also be formed in the body through the desaturation and elongation of 18:3n-3 (alpha-linolenic acid), an essential fatty acid. The same desaturation and elongation enzymes which metabolise alpha-linolenic acid (ALA) into EPA and DHA are also required to change linoleic acid (an essential omega-6 fatty acid) into omega-6 LCPUFA, such as arachidonic acid (AA). Therefore, there is competition between the essential fatty acids for the limited amounts of enzymes available.

Although vegetarian diets tend to be relatively high in alpha-linolenic acid (ALA) they are also high in linoleic acid (LA). High levels of LA (ie, greater than six percent of total dietary energy) may inhibit the synthesis of omega-3 LCPUFA from ALA. (5) It is, therefore, recommended that vegetarians consume more dietary sources of omega-3 fatty acids, to ensure that they achieve a balanced intake of omega-3 and omega-6 fatty acids. See Table 1 (NZDA) for dietary sources of omega-3 and omega-6 fatty acids.

❹ Figure 1 (NZDA) replaces Figure 1 in the ADA position paper, as it contains New Zealand food composition figures for common sources of iron, calcium, zinc, vitamin D vitamin B-12 and linoleic acid in the diets of New Zealand vegetarians. It is particularly important that vegetarians ensure good intakes of these nutrients, which are otherwise supplied in animal-derived foods.

❺ The New Zealand Ministry of Health published healthy eating guidelines for vegetarians in 1998. Within these guidelines the specific section on children and vegetarian diets reads as follows:

"Many vegetarian foods are bulky. Children's stomachs may be too small to eat all the food they need for activity and growth. Serve small meals often. Offer a range of vegetables and fruit, wholegrain breads and cereals, legumes, nuts and seeds, milk and milk products and eggs. Vegetarian children need food with iron, such as wholegrain cereals and breads, lentils, cooked dried peas and beans, dried fruits and dark green leafy vegetables. Serve these foods with fruit and vegetables high in vitamin C, such as tomatoes and oranges, to help iron absorption. When children do not drink milk, give other drinks such as soy milk with calcium and vitamin B-12 added. If a vegetarian child is not eating dairy products or eggs, ask your doctor of nurse about seeing a dietitian for further advice." (6)

❻ Long chain fatty acids in pregnancy, lactation and in infant feeding.

The essential fatty acid (EFA) requirements of all pregnant women (whether vegetarian or non-vegetarian) are high, due to the accretion of maternal, placental & foetal tissue. All pregnant women are thought to have a particularly high requirement for DHA. Pre-formed dietary DHA is thought to be specifically selected for use directly by the developing foetus. As vegetarians have a limited intake of pre-formed DHA, supplements of this fatty acid during pregnancy may be considered, especially when dietary linolenic acid intake is compromised (7). If supplemental fatty acids are given in pregnancy, the timing and length of supplementation should be considered. There is evidence that maternal nutritional status pre-conception and during early embryonic development, has a greater effect on the foetus than during the last two trimesters of pregnancy (8).

During lactation, 70–80 mg DHA per day are lost from maternal stores in breast milk. Breast milk levels of DHA in vegetarians, and especially in vegans, are lower than those of omnivores (7,9). It is, therefore, recommended that pregnant and breastfeeding vegetarians (particularly vegans) ensure that they consume an adequate intake of omega-3 fatty acids. See Table 1 (NZDA) for vegetarian dietary sources.

❼ Figure 2 (NZDA) replaces Figure 2 in the ADA position paper. This has been compiled using New Zealand guidelines from "Healthy Eating for Vegetarians" (6).

❽ Nuts in the vegetarian diet

Although from a number of different plant families, nuts contain protein, fats (primarily mono or polyunsaturated fatty acids), and a variety of micronutrients (10). They are also concentrated sources of energy. Nuts have long constituted an important part of a vegan or vegetarian diet (11,12), and are in the non-optional section of at least one vegetarian food pyramid (13).

Epidemiological evidence for the benefits of nut consumption among vegetarians exists, and the effective serving size of nuts consumed is relatively small (approximately 30g/day), although benefits are apparent over a wide range of intakes (14–16). Intervention studies have shown nut consumption to

***Table 1 (NZDA)*: Sources of omega-3 and omega-6 fatty acids**

Fatty Acid Type	Fatty Acid name	Dietary Sources
Omega 6 (n-6)	Linoleic (**LA)*** Arachidonic (**AA)**	Leafy green vegetables, seeds, nuts, grains, Vegetable oil (corn, safflower, soybean, sesame, sunflower)
Omega 3 (n-3)	Alpha-Linolenic (**ALA)**** Eicosapentaenoic (**EPA)** Docosahexanoic (**DHA)**	Fats and oils (canola, soybean, walnut, wheat germ, margarine and shortening made from canola and soybean oil) Nuts and seeds (butternuts, walnuts, soybean kernels, linseed) Vegetables (soybeans) Human milk Fish and shellfish

* LA can be metabolised to AA in the body
** ALA can be metabolised to EPA and DHA in the body

***Figure 1 (NZDA)*: Food sources of iron, calcium, zinc, vitamin D, vitamin B-12 and linolenic acid using New Zealand food composition figures.**

Iron	mg/serve
Breads, cereals, and grains	
Whole wheat/rye bread (1 slice)	0.5
White bread (1 slice)	0.3
Oatmeal (1 cup)	6.2
Wheat germ (2 Tbsp)	1.0
Cereal, fortified (½ cup)	3.0
Vegetables (½ cup cooked)	
Silverbeet	1.0
Spinach	1.3
Tomato juice (1 cup)	0.7
Turnips	2.4
Legumes (½ cup cooked)	
Baked beans	1.3
Black beans	1.9
Kidney beans	2.2
Lentils, red	1.8
Lima beans (100 g)	1.3
Soyfoods (½ cup cooked)	
Tofu	7.0
Soymilk, fortified (1 cup)	2.0
Nuts and seeds (2 Tbsp)	
Cashews	1.1
Pumpkin seeds	4.5
Tahini	1.6
Sunflower seeds	0.6
Other	
Molasses (1 Tbsp)	0.9
Egg (1 medium)	1.4

Calcium	mg/serve
Dairy Products	
Milk, whole (1 cup)	294
Milk, skim (1 cup)	377
Yoghurt, fruit (150 g)	192
Cheddar cheese (30 g)	221
Soyfoods	
Tofu (½ cup)	138
Soymilk, fortified (1 cup)	306
Nuts and seeds (2 Tbsp)	
Tahini (sesame seed paste)	106
Almonds	47
Vegetables (½ cup cooked)	
Broccoli	30
Turnips	74
Spinach	134
Silverbeet	57
Cabbage	31
Taro	119
Watercress (1 cup)	18
Parsley (1 Tbsp)	12
Fruits	
Dried figs (5)	160
Orange juice, unsweetened (1 cup)	23
Legumes (1 cup cooked)	
Black beans	49
Baked beans	12
Other	
Molasses (1 Tbsp)	41

Zinc	mg/ serve
Breads, cereals, and grains	
Wheat germ (2 Tbsp)	1.5
Legumes (½ cup cooked)	
Lima beans (100 g)	0.7
Lentils, red	0.6
Soyfoods (½ cup cooked)	
Tofu	1.4
Vegetables (½ cup cooked)	
Corn	1.3
Peas	1.1
Dairy Products	
Milk, whole (1 cup)	0.8
Cheddar cheese (30 g)	1.0
Yoghurt, fruit (150 g)	0.8
Nuts and seeds (2 Tbsp)	
Cashews	1.0
Pumpkin seeds	2.2
Sesame seeds	1.8
Sunflower seeds	1.0

Vitamin D	µg/ serve
Cereals, fortified (½ cup)	0.8
Margarine, fortified (1 tsp)	0.4

Vitamin B-12	µg/ serve
Dairy Products	
Milk, whole (1 cup)	0.9
Milk, skim (1 cup)	1.0
Cheddar cheese (30 g)	0.4
Yoghurt, fruit (150 g)	0.5
Other	
Soymilk, fortified (1 cup)	0.1
Cereals, fortified (1 serve)	0.6

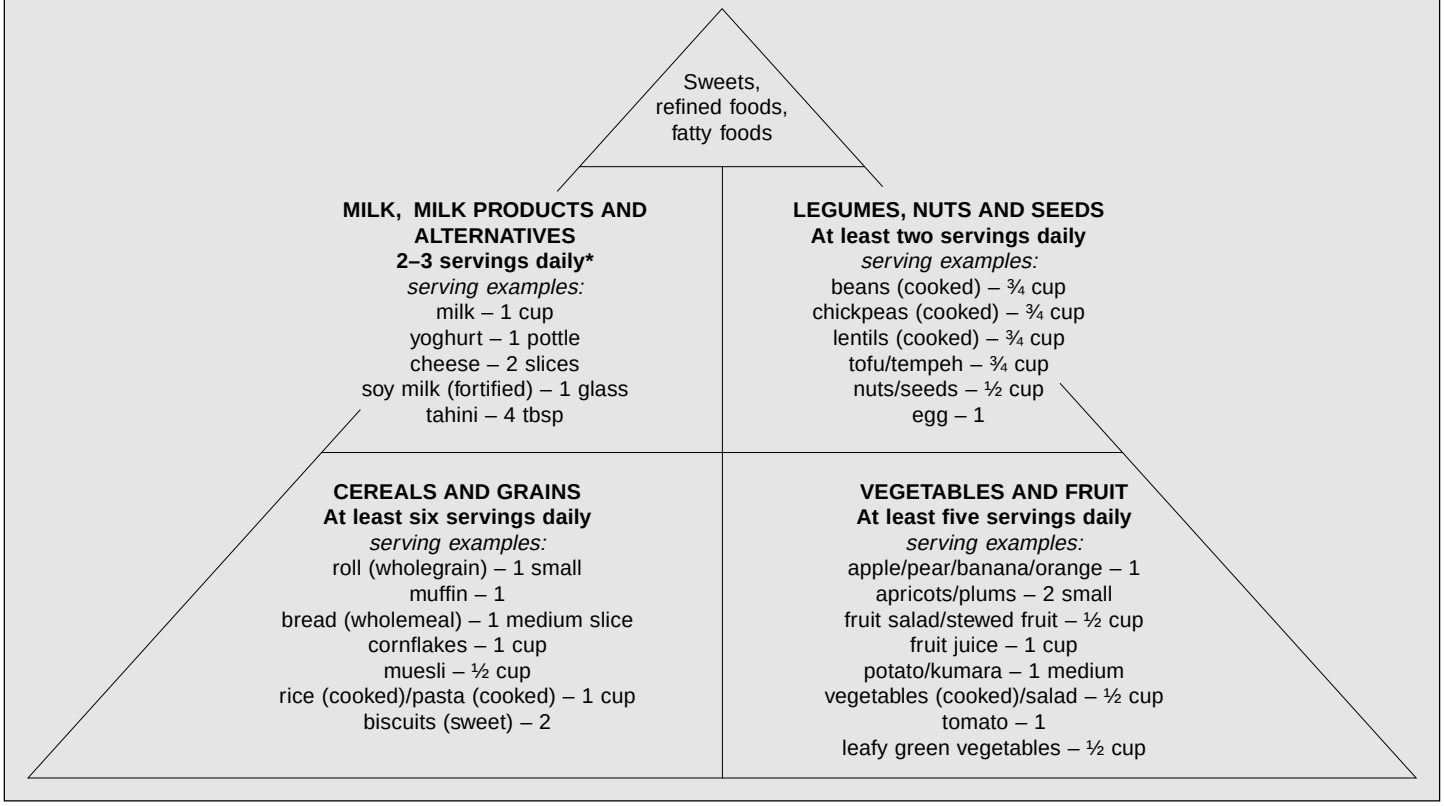
Linolenic acid	g/ serve
Flax seed (2 Tbsp)	4.3
Walnuts (30 g)	1.9
Walnut oil (1 Tbsp)	1.5
Canola oil (1 Tbsp)	1.6
Linseed oil (1 Tbsp)	7.6
Soybean oil (1 Tbsp)	0.9
Soybeans (½ cup cooked)	0.5
Tofu (½ cup)	0.4

have benefits on lipid, lipoprotein, and plasma fatty acid profiles (17–22). This is thought to be due to their high levels of monounsaturated fatty acids (10), their low lysine:arginine ratio (23,24), and relatively high vitamin E levels (25).

Nuts are also good to moderate sources of minerals which may play a cardioprotective role; magnesium, copper, selenium, manganese, boron and zinc (26-29). Brazil nuts are an excellent source of bioavailable selenium (21). The powerful anti-oxidant, Ubiquinol-10 (co-enzyme Q10) is also found in peanuts, pistachio nuts, walnuts and sesame seeds (10).

It is therefore recommended that vegetarians consume nuts, as they are an excellent plant source of many essential nutrients.

***Figure 2 (NZDA)*: Food pyramid for vegetarian meal planning**



* Vegetarians who choose not to use dairy products need to select another food source of calcium and vitamin B-12, see Figure 1 (NZDA).

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