Position Statement On

Adequate Intake of Nutrients on a Plant-Based Diet

The Complete Health Improvement Program (CHIP) promotes the wholefood plant-based diet eating pattern for optimal health. This position statement discusses the reasons for this recommendation.

Key messages

- *A balanced plant-based diet can easily meet dietary protein requirements.*
- *Choosing plant protein over animal protein may provide the health benefits generally associated with plant-based diets.*
- *While iron stores in vegetarians and vegans is lower, vegetarians who eat a varied, healthy diet are at no greater risk of developing iron deficiency anemia than omnivores.*
- *A well-planned vegetarian diet can provide adequate amounts of zinc from plant foods.*
- *There is no convincing evidence that lower intake of omega-3 fatty acids (EPA and DHA), seen in vegetarians and vegans, is adverse to health.*
- *Individuals who significantly limit intake of animal-based foods, and especially pregnant and breastfeeding vegan and vegetarian women, require vitamin B12-fortified foods or supplements.*
- *Vitamin D3 supplementation is warranted when sun exposure is inadequate for several months of the year, in areas of the world without fortified foods, among those who are dark skinned, the elderly, those who extensively cover their body with clothing for cultural reasons, and who commonly use sunscreen.*
- *Currently, there's no good evidence that consuming the recommended intake of calcium will reduce fracture risk, indicating that sufficient calcium is available in a vegetarian diet.*

Wholefood Plant Based Diets

Protein

Animal foods are considered high-quality protein foods because they contain large amounts of all the essential amino acids. There are some plant protein foods that are also considered high-quality proteins including soy, quinoa and amaranth. For other plant foods, the amounts of one or two essential amino acids may be a bit lower, typically in leucine, methionine, lysine and/or tryptophan, requiring the need to combine vegetable proteins (1). There is no need to consciously combine different plant protein foods at each meal, provided a variety of foods are eaten daily (1). This range should include legumes, whole grains, soy products, nuts and seeds.

A balanced plant-based diet can easily meet dietary protein requirements provided daily energy needs are met and plant protein is derived from a range of foods. Furthermore, there is growing evidence that choosing plant protein over animal protein may in fact provide the health benefits generally associated with plant-based diets, including a reduced risk of being overweight, obesity and chronic disease (1).

Iron

Plants contain less iron than meat and the type of iron is less easily absorbed. A common concern exists that people on vegetarian or vegan diets may be more susceptible to iron deficiency. We now know that while iron stores in vegetarians and vegans is lower, vegetarians who eat a varied, healthy diet are at no greater risk of developing iron deficiency anemia than omnivores (2). It should also be noted that there is no apparent advantage in storing more than a minimal amount of iron (2).

There are two types of iron: heme iron, and non-heme. Plants contain only non-heme iron, whereas animal products contain 40% heme iron and 60% non-heme iron. Heme iron is readily absorbed regardless of how much is needed, while non-heme iron is more controlled. Primarily, the absorption of non-heme iron is determined by the body's need for iron – people with the lowest iron stores will absorb more and excrete less (2). Its absorption is also affected by inhibitors and enhancers, which may cancel each other out.

Absorption is significantly improved by Vitamin C, which is typically abundant in wholefood plant-based diets rich in fruit and vegetables. Other organic acids (citric, malic and lactic acid), vitamin A and beta-carotene also enhance the absorption of non-heme iron (2). On the other hand, phytates (found in legumes, nuts, whole grains and unprocessed bran), polyphenol-containing beverages (tea, coffee, cocoa and red wines) and animal proteins decrease the absorption of non-heme iron (2). The effects of phytates can be minimized by food processing techniques such as soaking, sprouting and leavening (2). The effects of oxalic acid and calcium, once believed to inhibit absorption are now thought to have a limited effect (2). Nevertheless, despite the effects of the inhibitors on absorption of non-heme iron, vitamin C is a potent enhancer and is able enhance absorption up to six-fold in those with low iron stores (2).

A vegetarian diet with a variety of plant foods, including whole grains and cereals, nuts, seeds, dried fruits and green leafy vegetables, provides an adequate intake of iron with no greater risk of iron deficiency anemia than non-vegetarians (2).

Zinc

Phytates inhibit zinc absorption, but this can be minimized by various food processing methods, including soaking, heating, sprouting, fermenting and leavening. Taking iron supplements may also reduce absorption, while calcium and dietary fibre do not appear to be an issue (3). Despite differences in zinc intake between vegetarians and omnivores, the human body's homeostatic mechanisms mean that it able to adapt to lower zinc intakes by increased absorption and retention of zinc, and vegetarians have similar serum zinc concentrations to and no greater risk of zinc deficiency than non-vegetarians. This indicates that well planned vegetarian diets can provide adequate amounts of zinc from plant foods (3). Good sources of zinc include wholegrain breads and cereals, rolled oats, brown rice, nuts, seeds, legumes, tofu, soy products, and fortified breakfast cereals.

Omega-3 Fatty Acids

Polyunsaturated fatty acids comprise omega-6 and omega-3 fatty acids. Omega-3 polyunsaturated fatty acids (PUFAs) are important for cardiovascular health, eye and brain function. The common plant-derived omega-3 PUFA alpha-linolenic acid (ALA), acts as precursor of various longer chain fatty acids, the most important of which are docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). However, this conversion is inefficient and affected by various factors. EPA and DHA can be derived directly from foods, particularly marine plants (microalgae) and fish (4).

Intakes of ALA are similar in vegetarians and non-vegetarians, but intakes of EPA and DHA are low in vegetarians and negligible in vegans. Levels of EPA and DHA are typically stable and about 30 – 50% lower in vegetarians and vegans, however, there is no convincing evidence that this results in adverse effects. Given the evidence that wholefood plant-based eating patterns are associated with better health and longevity, further research is needed to assess whether dietary sources of EPA and DHA are essential for optimal health.

For those with increased needs for long-chain omega 3 PUFAs (e.g. pregnant and lactating women, people who are less able to convert ALA into EPA and DHA), steps can be taken to improve levels. These include: Increasing intake of ALA (however, supplementing with flaxseed oil, a rich source of ALA, has been shown to increase EPA but not DHA in plasma lipids (5)); decreasing intake of linoleic acid (LA), which competes with ALA for conversion enzymes; decreasing intake of trans fats, alcohol and caffeine; and quitting smoking. Another obvious option is to supplement with DHA and EPA. DHA and EPA supplements are derived from marine sources, such as fish or microalgae.

Vitamin B12

Vitamin B12 is produced by bacteria in the large intestines of animals, and is found almost exclusively in animal-based foods (6). Plant sources are either an inactive analogue, or grossly insufficient to supply the needs of vegetarians (6). Nonetheless, cases of frank vitamin B12 deficiency in vegetarians or vegans are rare (6).

Since vitamin B12 deficiency poses serious health risks such as anemia and neurological disorders that, unless detected and treated early can be irreversible, vegans and those who significantly limit intake of animal-based foods, and especially pregnant and breastfeeding vegan and vegetarian women, require vitamin B12-fortified foods or supplements. Deficiency may also be caused by loss of intrinsic factor in the stomach, loss of gastric acid (e.g. as a result of some medications as well as ageing), or loss of other protein-digesting enzymes. In fact, these contribute to 95% of known cases of vitamin B12 deficiency (6). Low daily requirements and highly efficient internal recycling of vitamin B12 mean that deficiency can often become evident only after a significant period of time, often years. Hence, vegetarians should have their B12 status regularly assessed to identify any potential problem (6).

In people who can absorb B12, small amounts and frequent daily doses appear to be more effective than infrequent large doses (6). Some studies indicate that fortified foods provide more readily absorbed vitamin B12 than that derived from other methods of supplementation. Supplements are not made from animal-based products and so are suitable for vegan diets (6).

Vitamin D

Vitamin D is important in the maintenance of bone health. Vitamin D deficiency has also been implicated in other conditions including cardiovascular disease, increased cancer risk and mortality, falls, sarcopenia, diabetes, multiple sclerosis, osteoarthritis, epilepsy and cognitive dysfunction (7).

Vitamin D status depends primarily on both sun exposure, and is also impacted by the intake of vitamin D from foods such as fatty fish, meat, eggs and fortified foods. Vegetarians therefore depend on sun exposure and fortified foods to provide their physiological needs (7), though it should be mentioned that vitamin D deficiency is not necessarily just a concern for vegetarians. For instance, in Australia the average dietary intake is 2-3 μg/day, which is below the recommended Adequate Intake level of 5 μg/day (8).

Vitamin D3 supplementation is warranted when sun exposure is inadequate for several months of the year, in areas of the world without fortified foods, and among those who are dark skinned, the elderly, those who extensively cover their body with clothing for cultural reasons, and who commonly use sunscreen are at an increased risk of vitamin D deficiency (7).

Calcium

Like vitamin D, calcium is important for bone health. In addition to dairy foods, good sources of calcium are also found in dark, green leafy vegetables, such as kale and collard greens, dried beans and legumes (9), as well as sesame seeds and tahini (sesame paste) (8). However, oxalic acid found in spinach and chard may reduce the bioavailability of calcium.

Currently, there's no good evidence that consuming the recommended intake of 1,000 to 1,200 mg/day will reduce fracture risk (9), indicating that sufficient calcium is available in a vegetarian diet. Furthermore, there is some evidence that calcium-only supplements (without vitamin D) do not protect against fractures, and may in fact increase risk of fractures (10), heart attacks (11) and prostate cancer (12), warranting a reassessment of the role of calcium supplements in the management of osteoporosis. For a more detailed discussion on calcium, please refer to the LMI Position Statement on ‘the role of dairy and animal protein in osteoporosis’.

References

1. Marsh KA, Munn EA, Baines SK. Protein and vegetarian diets. *MJAOpen* 2012; 1 Suppl 2: 7-10.
2. Saunders AV, Craig WJ, Baines SK, Posen JS. *MJAOpen* 2012; 1 Suppl 2: 11-16.
3. Saunders AV, Craig WJ, Baines SK. *MJAOpen* 2012; 1 Suppl 2: 17-21.
4. Saunders AV, Davis BC, Manohar LG. *MJAOpen* 2012; 1 Suppl 2: 22-26.
5. Harper CR, Edwards MJ, DeFilipis AP, Jacobson TA. Flaxseed Oil Increases the Plasma Concentrations of Cardioprotective (n-3) Fatty Acids in Humans. *J. Nutr.* 2006; 136: 83–87.
6. Zeuschner CL, Hokin Bd, Marsh KA, Saunders AV, Reid MA, Ramsay MR. *MJAOpen* 2012; 1 Suppl 2: 27-32.
7. Joshi D, Center JR, Eisman JA. *Aust Prescr* 2010;33:103-6
8. Reid MA, Marsh KA, Zeuschner CL, Saunders AV, Baines SK. *MJAOpen* 2012; 1 Suppl 2: 33-40.
9. Harvard School of Public Health. The Nutrition Source *Calcium and Milk: What's Best for Your Bones and Health?*2012. *http://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/calcium-full-story/* (accessed 17 July 2012)
10. Bischoff-Ferrari HA, Dawson-Hughes B, Baron JA, Burckhardt P, Li R, Spiegelman D, Specker B, Orav JE, Wong JB, Staehelin HB, O'Reilly E, Kiel DP, Willett WC. Calcium intake and hip fracture risk in men and women: a meta-analysis of prospective cohort studies and randomized controlled trials. *Am J Clin Nutr*. 2007; 86:1780–90.
11. Bolland MJ, Avenell A, Baron JA, Grey A, MacLennan GS, Gamble GD, Reid IR. Effect of calcium supplements on risk of myocardial infarction and cardiovascular events: meta-analysis. *BMJ*. 2010; 341:c3691. doi: 10.1136/bmj.c3691.
12. Giovannucci E, Liu Y, Platz EA, Stampfer MJ, Willett WC. Risk factors for prostate cancer incidence and progression in the Health Professionals Follow-up Study. *Int J Cancer.* 2007; 121:1571–78.