Diet & Bone Health

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Overview

In all developed countries with ageing populations, thinning of bones due to loss of calcium is a major public health issue. As bones thin, risk of fracture increases. Hip fracture is a particularly devastating injury, with many people dying within a year of suffering such a fracture. Osteoporosis and vertebral fractures give rise to the familiar loss of height with age and to the painfully familiar bent over stance of many elderly people. Measures to promote bone health are important throughout life to assist in building bone and to reduce later losses of bone.

Dietary recommendations have focussed almost exclusively on increasing calcium intake. Increasing calcium intake is not wrong in itself but, in relation to bone health, its undue pre-eminence over reducing sodium intake, increasing vitamin K and potassium intakes, moderating protein intake, increasing physical activity and adequate sun exposure is a serious error in public policy.

Calcium is lost from the body in urine, gut secretions and sweat. The key to avoiding bone loss is to ensure that calcium absorbed from food in the gut balances the calcium losses. Otherwise, the body will take calcium from bone to maintain the required level of calcium in the blood.

In people following typical North American and European diets, calcium loss is driven with approximately equal importance by high sodium (salt) intakes, high protein intakes and low potassium intakes. Realistic changes in these three components can cause calcium requirements to vary from 240 mg per day to over 2000 mg per day.

The ideal foods for bone health are those which are high in calcium and also reduce calcium losses. Green leafy vegetables such as kale and spring greens are the best example. In contrast, all dairy foods increase calcium losses as well as providing calcium. Foods such as meat, fish and eggs, which are low in calcium but cause high losses, have a strong adverse effect; low calcium foods which reduce losses, such as peppers, bananas and oranges, provide everyone with a modest boost.

For an individual trying to improve calcium balance, fruit and vegetables are the best foods to add, as they are rich in potassium which reduces calcium losses. 100 g each of red peppers, bananas, oranges, kale and spring greens will boost retained calcium by about 40 mg per day - enough to reverse a 1% loss of bone calcium per year. A pint of cow's milk would have a similar effect for an average person, but only about half the benefit for individuals with low calcium absorption, who are at particular risk of osteoporosis. Cheddar cheese causes calcium loss in high risk individuals and cottage cheese causes calcium loss for most people.

If protein intake is inadequate (less than 0.8 g of protein per kg of body weight), the body lacks the building blocks for muscle and bone, and growth hormones which stimulate muscle and bone building will decline to undesirable levels. Consuming less than the recommended amount of protein in order to reduce calcium loss is therefore a false economy. Individuals with a low calorie intake are particularly at risk of getting insufficient protein.

The choice of protein source can make a great deal of difference. A person trying to increase protein intake using meat or fish will lose 25 mg of calcium from their body for every 100 g eaten. In contrast, a 100 g portion of beans (by dry weight) has an approximately neutral effect on calcium balance while providing the same amount of protein.

Alkaline foods (typically high in potassium relative to protein) increase blood pH, thus protecting

bone. Vegetable sources of protein (other than grains and some nuts) are usually alkaline, while animal sources of protein are usually acid. Milk is approximately neutral, but cheese is even more acid than meat or fish.

Reducing salt intake by 5 g per day (about half of average Western intake) will reduce calcium losses by about 35 mg per day.

Adequate vitamin D can improve absorption of calcium from food. In contrast, caffeine reduces calcium absorption.

Other factors also help to maintain strong bones. Vitamin K, from green leafy vegetables and broccoli, helps to protect and strengthen bone, particularly in post-menopausal women. Vitamin C and magnesium also help to build and strengthen bone. Omega-3 fatty acids may also have a beneficial effect.

Retinol (pre-formed vitamin A) makes bone loss more likely. Plant carotenes - abundant in carrots, dark green leafy vegetables and red peppers - allow the body to make as much vitamin A as it needs without adverse effects on bone health.

Physical activity has a huge impact in encouraging the body to build and retain strong bones, taking the necessary calcium from food rather than from the bones.

Recommendations

- **Eat plenty of low oxalate high calcium green leafy vegetables**

Dairy products are not the ideal food for bone health. 100 g of a low oxalate high calcium green leafy vegetable such as kale, turnip greens or spring greens will have at least as much beneficial effect on calcium balance as 200 g of milk. Using the green stuff instead of the white stuff also avoids the adverse effects of dairy fat on cardiovascular health. Dark green leafy vegetables will protect and strengthen bone by raising blood pH and providing vitamin K and vitamin C. They are a good source of plant carotenes, which meet the body's needs for vitamin A safely and naturally. Green leafy vegetables are also high in folate, which is highly beneficial to general health. It is hard to imagine a food more supportive of bone health than kale or spring greens.

Some vegetables such as spinach, purslane and rhubarb are high in oxalate, which hinders absorption of their calcium.

- **Reduce sodium intake**

If you use salt, substitute one of the widely available low sodium alternatives, such as LoSalt, containing at least twice as much potassium as sodium by weight.

Use low sodium bread or consume bread moderately, as bread is a major source of sodium. Some low sodium breads, such as Warburton's Healthy breads, are also fortified with calcium.

Use herbs and spices instead of salt and salty pickles. There are often similar products in terms of taste with very different salt levels.

- **Get at least 600 mg of calcium per day from calcium rich foods or supplements**

Kale and spring greens provide about 150 mg of calcium per 100 g raw weight.

Almonds, carob and molasses each provide about 250 mg of calcium per 100 g. While these foods are too concentrated to consume in large amounts, they can make a useful contribution. They will also provide alkali to boost blood pH.

Tofu is high in calcium only if calcium has been used in making it, and some tofu is highly salted. Tofu can therefore vary from substantially increasing calcium balance to substantially decreasing it. The calcium content of tahini is also very variable. The amounts of calcium and sodium in these

foods should therefore be checked on the labels and not taken for granted: for a reliably beneficial effect on bone health there should be at least as much calcium as sodium.

Calcium-fortified foods or calcium supplements provide a further convenient source of calcium. If phosphate intakes are low (unusual for vegans), calcium phosphate may be preferable to calcium carbonate or calcium citrate. Calcium carbonate should always be consumed with meals. If stomach acid is low, something other than carbonate should be used.

Taking 600 to 1000 mg of calcium per day from calcium rich foods, plus smaller amounts from other foods, will provide an adequate calcium intake.

- **Get an adequate protein intake from plant foods**

Some highly processed plant protein sources, such as certain soy protein isolates, have an adverse effect on calcium balance due to loss of beneficial minerals and addition of sodium during processing. Highly salted nuts also have an adverse effect. Most plant protein sources (fruits, vegetables, legumes and many nuts and seeds) have a positive or neutral effect on calcium balance. Unrefined plant foods are also excellent sources of magnesium.

A cup of soy milk provides about 8 g of protein. Most dried beans provide about 25 g of protein per 100 g. Wheat is higher in protein than rice and potatoes, and using nuts and seeds rather than oils and fats will boost protein intake. Nuts which are high in monounsaturated fat, such as almonds, hazelnuts and cashews, are ideal as they will also promote cardiovascular health. Almonds are the most beneficial for bone health as they have the most positive effect on calcium balance.

- **Maintain an adequate store of vitamin D**

Get frequent short exposures of skin to sun whenever the sun is at least 30 degrees above the horizon. At latitudes above about 50 degrees North, this is not practical from November to March, and vitamin D stores will decay substantially during this "vitamin D winter". Within 30 degrees of the equator there is no vitamin D winter. A fifteen minute exposure to sun is ample to boost vitamin D while avoiding damaging sunburn.

For the part of the year when such sun exposure is not possible, either take a mid-winter holiday somewhere sunny and expose skin to sun frequently or take 10 micrograms of vitamin D2 (ergocalciferol) per day.

- **Eat plenty of vegetables and fruit and include omega-3 fatty acids in your diet**

The simplest way for vegans to top up omega-3s is to consume a teaspoon of culinary grade flaxseed (linseed) oil per day.

- **Limit caffeine consumption**

Caffeine has been shown to reduce calcium absorption. Low caffeine teas, such as Redbush (Rooibosch), provide a tasty and healthful alternative.

- **Get your vitamin A from plant carotenes, not from retinol**

Some vegan supplements contain retinol or related compounds - ingredients beginning with "retin" should be avoided. Good sources of plant carotenes include carrots, pumpkin, sweet potato, dark green leafy vegetables, such as kale, spring greens and spinach, and red peppers. 100 g per day of any combination of these will meet vitamin A requirements safely and naturally.

- **Finally, don't forget physical activity**

Just as exercise helps to build and maintain muscle, it also helps to build and maintain bone.

As well as benefiting bone, these recommendations will benefit overall health. Increased potassium and calcium intakes and reduced sodium intake strongly promote lower blood pressure and reduce risk of stroke and kidney disease. Increased calcium and vitamin D appears to reduce risk of

colorectal cancer and may also reduce risk of breast cancer. Increased vitamin D may also reduce the risk of prostate cancer and auto-immune diseases. Increased consumption of foods rich in plant carotenes is associated with reduced risk of cancer. Increased consumption of omega-3 fatty acids, particularly from plant sources, is strongly associated with reduced risk of heart disease. Omega-3 fatty acids may also reduce risk of depression and schizophrenia.

Increased consumption of unrefined plant foods, particularly fruit and vegetables, nuts, seeds and whole grains, is associated with wide-ranging health benefits and can be expected to promote a longer and healthier life.

Two serious errors in public policy on bone health

The first serious error in public policy is the undeserved pre-eminence accorded to calcium in relation to bone health. Calcium is a very good thing, but increasing calcium intake from 500 mg per day to 1500 mg per day will add less than 90 mg per day to the calcium balance of most older adults, and less than 50 mg per day to the calcium balance of many of them while 10 g of salt per day will take away about 70 mg. On the other hand, 4000 mg of extra potassium from a diet rich in vegetables, fruits and other unrefined plant foods will add 60 mg per day to calcium balance. Vitamin K from green leafy vegetables and broccoli will promote stronger bones.

The second serious error is equating calcium with dairy products. Dairy products are not the best source of calcium as they promote calcium losses at the same time as increasing calcium intake.

Our prehistoric ancestors got about 1500 mg of calcium per day from plants. Their high intake of vegetables, fruits, roots and flowers also provided abundant potassium, magnesium, vitamin K and vitamin C, all in quantities far above modern norms. Salt was notably absent, as were dairy products. While many modern cultivated foods are sadly much less rich in calcium than the wild plants with which we evolved, green leafy vegetables are an exception and therefore of particular importance for modern humans.

Human use of dairy products is a recent and unnecessary development: a diet rich in vegetables, fruits and root crops and low in salt provides the best path back to healthy bones.

(Article from the Vegan Society website)