

# Prevention of Osteoporosis

## 1. Calcium

Calcium is one of the essential nutrients necessary for healthy bone development. Adequate calcium intake is necessary for the attainment of peak bone mass in the early 20's (i.e the highest level of bone strength which occurs at completion of growth) and therefore strong healthy bones, which will sustain the effects of ageing on the skeleton. Hence it is important to have a well balanced diet with adequate amounts of dairy products, which are the primary source of foods rich in calcium.

Not only is calcium important to bones, it is also important for the function of various organs within the body. There also is a certain amount of calcium which circulates within the blood, with the levels of calcium in the blood being tightly regulated. If blood calcium levels fall as may occur with inadequate calcium intake in the diet, the body will compensate for this by drawing calcium out of bones and putting it into the blood. Calcium is also excreted by the body daily. Hence, it is important to have an adequate daily calcium intake through the diet, so that bone mineral strength is not compromised.

<b>Recommended Daily Calcium Intake</b>		
<b>Category</b>	<b>Age</b>	<b>Calcium (mg)</b>
Children	1-3 years	700
	4-7 years	800
Girls	8-11 years	900
	12-15 years	1200
	16-18 years	800
Women	19-54	800
	54+	1000
Pregnancy: last 3 months		1200
Lactating		1200
Boys	8-11	800
	12-15	1200
	16-18	1000
Men	19-64	800
	64+	800

*These recommendations are to be revised within the next few months.<sup>2</sup>*

## Calcium Requirements Throughout Life

There are critical times in life when it is vital to ensure that calcium intake through food and/or supplements are adequate.

## **Childhood and Adolescents**

During childhood and adolescence, when the skeleton is actively growing it is essential that calcium intake meets the requirements of the growing skeleton. It is during this growth phase that the foundations for the attainment (achievement) of peak bone mass are laid. In the years following the growth phase, dietary calcium is required to maintain peak bone mass.

## **35 to midlife (50's)**

From the mid 30s onwards bone loss starts to occur. It is part of the normal ageing process that bones lose their mineral (calcium) and collagen (protein) content. For women this process of bone loss is also accelerated further at the time of menopause. Thus if an individual starts with a high peak bone mass, their skeleton will withstand the effects of the age related bone loss better than the individual who has a low peak bone mass and who will be more likely to develop osteoporosis at a latter stage.

## **Pregnant and breastfeeding women**

Pregnant women and breastfeeding women need to ensure that they have adequate calcium intake. In pregnancy, especially in the third trimester of pregnancy, calcium requirements are increased, in order to meet the requirements for bone mineralization in the foetal skeleton. Women who breastfeed also have high requirements for calcium in order to allow for milk production. Normal pregnancy and breastfeeding is associated with a certain amount of bone mineral loss, which generally recovers 6 – 12 months after the cessation of pregnancy and/or breast feeding.<sup>3</sup>

## **Midlife**

Midlife and beyond is a time when calcium requirements are also high. When women go through menopause, there is a rapid loss of bone that is primarily due to estrogen deficiency and this process may last from 4 – 8 years after menopause.<sup>4</sup>

It is also known that women generally start to lose bone even in the years leading up to menopause due to the fact that estrogen levels are already starting to drop even though periods may still be occurring.<sup>5</sup>

It is also a time when the gastrointestinal system becomes less efficient at absorbing calcium from food and it is believed that this process is also due to the loss of estrogen. The kidney also becomes less efficient in conserving calcium. This creates a state of potential calcium loss in the blood, and the body compensates for this by drawing calcium out of the bones.<sup>4</sup>

Thus not only do the bones become weaker because of estrogen deficiency at menopause, they also lose more calcium. Hence the way to reduce the loss of calcium from the bones is to increase the intake of calcium from food.

## **Older years**

In the years beyond menopause the rate of bone loss as a consequence of estrogen deficiency slows down. However, there is still a requirement for high intake of calcium through the diet so as to offset the process of calcium being drawn from the bones in order to compensate for inefficient calcium absorption from the gastrointestinal system and kidney.<sup>4</sup>

## 2. Vitamin D

This nutrient is vital for the development of healthy bones. Vitamin D serves several important functions in relation to calcium metabolism. It helps to increase calcium absorption from the gastrointestinal system and kidney and thereby make it available to body tissues and the blood. It also functions to aid with the deposition of calcium to bone.

The body's main source of vitamin D arises from the manufacture of this vitamin in the skin on exposure to sunlight. Only 10 – 15 minutes of exposure to outdoor sun on the face and arms daily, is necessary for adequate production of vitamin D. However, it is important to avoid excessive exposure from sunlight, particularly in Summer due to the risk of skin damage and skin cancers.

Dietary sources of vitamin D are poor sources of this nutrient and do not contribute significantly to vitamin D levels in the body. These sources of vitamin D from the diet arise often from foods fortified with vitamin D such as milk, soy drinks, margarine and cereals. It is also found naturally in liver, fish (tuna, salmon, sardines, herring and mackerel) and egg yolk.<sup>6</sup>

Certain individuals with limited exposure to sunlight are at risk of vitamin D deficiency. The institutionalised<sup>7</sup>, housebound elderly<sup>8</sup>, veiled women and dark skin individuals may be at risk of vitamin D deficiency<sup>9</sup>. Also individuals with illnesses of the gastrointestinal system such as Coeliac disease<sup>10</sup> may not absorb adequate amounts of vitamin D from the diet. In high-risk individuals such as the elderly or those found to have low levels of vitamin D, vitamin D supplements are appropriate<sup>11;12</sup>. In addition, if calcium intake from dietary sources is inadequate, the use of calcium supplements may be necessary.

In order to determine if you are lacking vitamin D, it is best to see your doctor and have a blood test to measure your vitamin D levels.

You should discuss with your doctor whether you require supplements of calcium or vitamin D.

## 3. Exercise

It is important that physical activity be undertaken throughout life. In childhood and adolescence, exercise has beneficial effects in terms of bone development and attainment of a high peak bone mass by the early 20's.

Physical activity performed in the adult years will help to maintain bone strength and improve balance and co-ordination, which may prevent the occurrence of falls when elderly.

### **Exercises which are beneficial for bone health**

#### **Resistance training exercises**

These exercises are also known as strength training exercises. Strength training uses weights of some kind for example machines, dumbbells, ankle or wrist weights, to create

resistance which helps build muscle mass and places a load (force) on the involved limb bones. It also includes exercises, which use one's own body weight as the load (eg. push-ups, whereby the load is placed through the arms and shoulders). Load placed on bone leads to increased bone formation at the site where the load is greatest.<sup>13</sup> Ideally strength-training programs should be performed regularly, 2-3 times per week.

### **Weight-bearing exercise and High impact exercise**

Weight bearing exercise refers to exercises, which are performed in the standing position and involves loads (forces) being placed through the leg bones and spine. Examples of weight-bearing exercise include walking, running, tennis and dancing. Studies to evaluate the effects of weight bearing exercise such as walking have not shown as drastic an improvement in bone mass unless this activity is performed as a high intensity activity (eg walking at a fast pace, jogging etc).<sup>14</sup>

High impact exercises generally refers to weight bearing exercise which involves more load placed through the leg bones and spine during landing after lifting ones own body weight off the ground. Examples of this form of exercise includes running, skipping, jumping, team sports (eg netball) and high impact aerobics.

There is evidence to suggest that both high impact loading and resistance type (strength training) exercise probably provides the most benefit for improving bone mineral density.<sup>13-19</sup> However, there is no data, which shows that these exercises actually reduce the incidence of fractures.<sup>20</sup>

### **Exercises with minimal effects on bone health**

Bike riding and swimming where there is minimal load placed on bone has minimal effect in improving bone mass. However, these forms of exercise are beneficial in terms of improving cardiovascular health and muscle strength.<sup>21</sup>

## **4. Importance of Hormones**

The sex hormone estrogen plays a vital role in the development of the skeleton in females.

### **Adolescence**

During puberty the increased levels of the sex hormones lead to an increase in size and bone mass of the skeleton.<sup>22</sup> Ongoing production of estrogen is vital in adolescent females and young women so as to maintain bone mass. Reduced exposure to estrogen during life as can occur when there are absent or infrequent menstrual cycles, delay in the onset of the first period or early menopause will affect the attainment of peak bone mass and maintenance of bone mass.

### **Preceding menopause**

Even in the years immediately preceding menopause there can be a drop in estrogen levels that leads to a fall in bone mineral density.<sup>5</sup>

## **Menopause**

Menopause is associated with a dramatic fall in estrogen levels that result in significant loss of bone mass, which can last from 4 to 8 years after the onset of menopause. This bone loss initially mainly affects the spinal column (vertebrae). Usually, however, most bone is lost in the first 3 years after menopause and then the rate of bone loss slows. During the first 3 years after menopause, women may lose up to approximately 2% of bone mass per year especially in the spinal bones (vertebral bones).<sup>5,23,24</sup> The extent of bone loss in hips and wrist may be similar or slightly less.<sup>5,23,24</sup> Once women have passed through this rapid rate of bone loss, the rate of bone loss significantly slows and women generally can expect to lose approximately less than 1% of bone density at the hip per year, with the rate of change in the spine being even slower.<sup>5,23,24</sup>