

Maximising Peak Bone Mass and the importance of calcium



Peak bone mass is achieved between 20-30 years of age. Genetics and lifestyle factors, including nutrition and exercise, determine peak bone mass and the risk of osteoporosis (brittle bones) later in life. There are a variety of nutritional factors that influence peak bone mass but by far the most important is calcium.

How much calcium do teenagers need?

The difficulty in defining calcium requirements is there is no simple blood test to identify whether or not a person is calcium deficient. Because the skeleton acts as a calcium reservoir, whenever calcium levels fall in the blood calcium is released from bone. At the same time, the body also retains more calcium from urine and improves calcium absorption from the gut. Serum (blood) levels of calcium are tightly controlled by hormones which regulate calcium, parathyroid hormone (PTH) and vitamin D. A fall in serum calcium levels results in an increase in PTH which in turn increases serum calcium from bone resorption. Even though a low calcium intake will affect the size of the skeletal reserve of calcium, bone mass is also affected by other non-nutritional factors such as genetics, hormonal status and exercise. Therefore, a low dietary intake of calcium will not necessarily result in low bone mass but will increase the risk especially if low calcium intake occurs over a long period.

Traditionally calcium balance studies have been used to define calcium requirements, however, there is a move towards using bone density as an indirect measure of calcium requirements. This approach assumes that calcium requirements are linked with changes in bone density. Assuming calcium makes up about 32% of bone mineral density a figure for calcium retention in bone can be calculated. The Dietary Reference Intakes (DRI), released in 1997 by USA and Canada, have taken bone density studies into account in setting the Adequate Intake (AI) level. The AI level has been set at 1300mg of calcium per day for 9-18 year olds. There may be problems

with some of the underlying assumptions, however. A review of available studies at the time, found this figure to be a reasonable goal for calcium intake for this age group. This raises an important issue. How achievable is this level of calcium intake through diet alone?

In Australia, the Recommended Dietary Intakes (RDI) are currently under review. The current RDIs, which are lower than the AI, are shown in the Table 1 below.

Australian Recommended Dietary Intake (RDI) for calcium for children and teenagers compared with the actual intakes from 1995 National Nutrition Survey.

	RDI for calcium (mg)		Actual calcium intake (mg)	
	Males	Females	Males	Females
8-11 yrs	800	900	938	796
12-15 yrs	1200	1000	1092	784
16-18 yrs	1000	800	1280	801

The increased amount of calcium across the age range allows for growth with puberty. Regardless of the RDI, in comparison to the AI set by USA and Canada, it is clear from the 1995 National Nutrition Survey (NNS, Table 1 above) that Australian girls are not consuming anywhere near the recommended amount of calcium for girls aged 8-15 years. In the 12-15 age range the RDI is 1000mg but the mean intake was less than 800mg/day. Research from the Saskatchewan Pediatric Bone Mineral Study, where teenagers have been followed since before they matured, showed the time around puberty is the most critical for adding new





bone. Girls with higher calcium intakes gained more bone than girls on low calcium intakes. This suggests that during the phase of rapid bone growth, bone mineral retention may be limited by a low calcium intake. This is further supported by several studies in children, in which their diet has been supplemented with calcium

(either as a tablet or from dairy foods), which showed positive effects on bone density when the calcium intake is more than 900mg/day.

There is also emerging evidence that calcium intake may be negatively associated with body fat in children. Children who have a low calcium intake are more likely to be overweight or obese. At this stage it is not clear whether or not the source of calcium is important but clearly there are more benefits from increasing calcium from food because this will improve the overall quality of the diet.

What are the best sources of calcium?

The food sources of calcium are shown in Table 2.

Calcium content of foods		
Food	Serve size	Calcium (mg)
Whole milk	1 cup	295
Skim milk	1 cup	320
Calcium fortified milk	1 cup	415
Buttermilk	1 cup	375
Reduced fat milk	1 cup	350
Calcium fortified soy drink	1 cup	275
Yoghurt	200g tub	300
Yoghurt, reduced fat	200g tub	340
Cheese, cheddar	1 slice (20g)	155
Cheese, reduced fat	1 slice (20g)	160
Ricotta cheese, reduced fat	100g	245
Cottage cheese	100g	70
Ice cream, reduced fat	2 scoops	26
Custard	1 cup	250
Salmon with bones	100g	375
Tahini, sesame butter	20g	66
Parsley	20g	50
Almonds	1 tablespoon	6
Bean curd (tofu)	100g	330
Spinach	100g	61

* source: AUSNUT 1999



Dairy foods provide the major sources of calcium and provide a readily absorbed form of calcium. Consumption of dairy foods tends to decline in girls after the age of 12 years.

The effect of soft drinks on calcium loss from the kidney has been the subject of debate, however a recent study found no effect. The authors suggested that carbonated drinks may displace milk based drinks from the diet. This is in fact supported by the NNS which showed that in both males and females the intake of non-milk drinks increases across the teenage years. Recent figures from the Australian Bureau of Statistics has shown a marked increase in carbonated beverage consumption over the past decade.

In addition, teenagers are also much more likely to eat away from home (70% for boys and 68% for girls) than younger children. Teenage girls are also more likely to have tried dieting as a means to control their weight. In an energy restricted diet it is much more difficult to meet calcium requirements. All of these factors make it more difficult for teenagers to consume an adequate amount of dietary calcium.

How do we get the message across?

The importance of calcium intake during the teenage years is difficult to dispute. At the same time it is clear that teenagers, especially girls, are not having enough dietary calcium. How can we impact this?

Changing dietary behaviour is difficult especially where there is no immediate benefit to the individual. If teenagers increase their calcium intake they won't feel any different.

The dilemma we have as carers is that we are asking them to change their behaviour now and that if they don't it will impact them in 50 or 60 years. A very long time indeed.

The challenge is to better understand what motivates teenagers. We know that body image is important to teenagers so perhaps we should be moving the focus from promoting calcium just for their bones to promoting calcium for maintaining a healthy body weight. Although the research in this area is far from conclusive is it time to rethink our approach?



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