

### The importance of calcium in osteoporosis prevention<sup>1</sup> Official position of the Osteoporosis Society of Canada<sup>2</sup>

Osteoporosis is a common bone disorder occurring mainly in postmenopausal women which results in decreased bone strength and increased susceptibility to fracture. It is a major health problem in Canada, causing fractures, disability, pain and deformity in a growing number of Canadians. Osteoporosis also is a frequent cause of height loss in older women. Hip fractures related to osteoporosis are a serious problem in the older age group, resulting in death in 12 to 20% of cases and disability in up to 75% of surviving patients. Since osteoporosis affects approximately one in four women after the menopause, it is estimated that as many as 2.5 million Canadians may be at risk of osteoporotic fracture during their lifetime.

Economic costs are highly significant. A recent estimate put the health care costs of osteoporosis in the U.S. at over \$8 billion annually; figures for Canada are unavailable, but are likely to be correspondingly high. Equally important is the resultant decrease in the quality of life for many of our older citizens. Osteoporosis occurs when the normal processes of bone formation and bone resorption become unbalanced and resorption exceeds formation. These processes are complex, and are influenced by a number of hormonal, metabolic, and lifestyle factors.

The major constituent of bone mineral that gives bone its characteristic strength and hardness is calcium; 99% of body calcium is in the skeleton. It is, therefore, logical to assume that calcium is an important nutrient for bone health.

In recent years calcium intake from diet and calcium supplements has become a focus of public interest and controversy. The Canadian public has received conflicting opinions regarding the advisability and effectiveness of increased intake of dairy products and/or the use of calcium supplements. The Osteoporosis Society of Canada felt it necessary, therefore, to review all available evidence in order to determine the importance of calcium for bone health and to inform Canadians of their current position.

While some studies strongly suggest that low calcium intake may play an important role in causing osteoporosis, further research is needed to establish the extent to which the amount of dietary calcium intake affects health, and the exact relationship between calcium and other nutritional, hormonal, metabolic, and lifestyle factors related to osteoporosis.

Some studies have shown an association between calcium intake and the rate of hip fracture in the elderly. On the other hand, recent studies measuring the amount of bone mineral do not show consistent effects on spinal bone mass of calcium supplements. The effects of calcium may be different in different parts of the skeleton, and they may be different at different ages. The Osteoporosis Society of Canada recognizes that the final answers to these questions will not likely be available in the

near future. On the other hand, the Society also recognizes the need of the public for current information upon which to base their own practices. In spite of the current lack of definite information, it is the position of the Osteoporosis Society of Canada that it is possible and reasonable to make recommendations which, based on current evidence, may maximize possible protective effects against osteoporosis. Continued and intensified research will undoubtedly allow these recommendations to be periodically revised in light of scientific advances.

#### Recommendations

**1** Individuals should consume adequate amounts of calcium. The Society supports the current recommendations of Health and Welfare Canada<sup>3</sup> regarding calcium intake (Table 1). Such calcium intakes are of potential benefit, entail little risk, and are easily achieved with the current food supply. While there is some conflict in the literature regarding the skeletal effects of taking higher amounts of calcium, there is a general agreement that dietary calcium deficiency could seriously affect bone health and predispose one to osteoporosis. Adolescents or adults with habitual calcium intakes less than 500 mg daily have an increased risk of being deficient in calcium. While actual requirements for calcium are different for each individual, the intakes recommended for the Canadian public should ensure sufficient dietary calcium for almost all individuals.

**2** Canadians should attempt to meet their calcium requirements first through food sources, principally dairy products. Dairy products are the richest natural sources of calcium. Milk is also supplemented with vitamin D, an essential nutrient which aids the absorption of calcium in the intestine. Recent evidence suggests one should not rely on foods of plant origin as a major source of calcium, although these foods are an important source of other nutrients. Calcium in vegetable foods may be relatively unavailable for use by the body in comparison to that in dairy products.

**3** If it is not possible to meet calcium requirements through dietary sources, Canadians should consider the use of a calcium supplement. This may be as important for adolescents and young adults as it is for older individuals. Many types of supplements are available. Current studies do not suggest any major difference in the effectiveness of different types of pharmaceutical calcium supplements, and indicate that calcium is absorbed as effectively from such supplements as from milk.<sup>4</sup> The products should be labeled with the amount of elemental calcium they contain rather than the amount of calcium salt.

**4** Canadians should support scientific research on osteoporosis. Scientific research is essential if we are to make progress in the fight against osteoporosis, and Canadian scientists are in a position to make a significant effort in this field. There is urgent need for studies in the following areas of special importance with regard to calcium nutrition:

- the effect of calcium intake and other factors on the attainment of optimal bone mass by age 30 to 35 years, prospective studies in particular;

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TABLE 1  
RECOMMENDED INTAKES OF CALCIUM<sup>3</sup>

Age	Sex	Calcium mg/day
<b>Months</b>		
0-5	Both	350
6-11	Both	400
<b>Years</b>		
1-3	Both	500
4-6	Both	600
7-9	Both	700
10-12	M	900
	F	1000
13-15	M	1100
	F	800
16-18	M	900
	F	700
19-49	M	800
	F	700
50+	Both	800

- the relationship between dietary calcium intake and bone mass in different areas of the skeleton in various age groups, particularly beyond age 70;
- the bioavailability of calcium in various foods and calcium supplements;
- more longitudinal studies are required on the effect of increasing calcium intake on calcium balance, particularly in women, and at higher calcium intakes;
- more studies are necessary on the interrelationship between dietary fibre and calcium requirements, and the relationship between the degree of physical activity and calcium requirements.

Canadians can support osteoporosis research through government agencies, or through the Osteoporosis Society of Canada.

#### Recommendations for specific population groups

Nutrient recommendations are made for populations of individuals and are estimated for healthy people of average body size. Individual requirements may differ depending on body weight and other factors such as age, medications, and various disease conditions.

#### 1 Period of skeletal growth – childhood to age 30

Adequate intakes of calcium are required for normal skeletal growth and the attainment of optimal height.

Intakes currently recommended by Health and Welfare Canada should be adequate to ensure optimal linear bone growth during childhood. Current information suggests that bones continue to grow in thickness and strength during adolescence and early adult life (up to age 30 or 35). It is important to gain as much bone as possible during this period of skeletal growth in order to offset the effects of bone loss which may occur in later life. Thus, adequate calcium intake may be particularly important during adolescence and early adulthood. Dietary surveys indicate that the diets of many female adolescents and young adult females currently contain very low amounts of calcium. Seventy-five percent of females over the age of 15 consume less than recommended levels. This is of major concern, since two recent retrospective studies suggest that low calcium intake during childhood and adolescence correlates with lower bone mass in the premenopausal and postmenopausal age groups.<sup>5,6</sup> Lactating adolescents are particularly vulnerable to calcium deficiency, having requirements that are even greater than for non-lactating adolescent females or lactating adults.<sup>7</sup>

#### 2 Premenopausal women – age 30 to 50

Current treatment for osteoporosis in postmenopausal women is of uncertain effectiveness. Thus it is desirable for younger women to adopt a lifestyle and dietary habits which may aid in osteoporosis prevention. While several studies point to a preventive effect of high calcium intakes against osteoporosis in women in this age group, the evidence is not conclusive. Some studies suggest that calcium intake may have more importance for bone in the hip and extremities while having less effect on the spine. After weighing available evidence, the Osteoporosis Society recommends the consumption of 700 mg calcium daily, as also recommended by Health and Welfare Canada.<sup>3</sup>

#### 3 Postmenopausal women without osteoporosis

Some studies have suggested that intakes higher than currently recommended (1200–1500 mg/day) might help to prevent bone loss in postmenopausal women. On the other hand, several studies measuring spinal bone have not shown any effect of dietary calcium supplements on the rate of bone loss. After viewing all current evidence the Society has concluded that there is at present insufficient evidence to increase the current recommendation (800 mg). Simply increasing calcium intake to high levels cannot guarantee osteoporosis will be prevented. Very recent studies suggest that calcium supplements cannot substitute for estrogen in the prevention of spinal bone loss in early postmenopausal women,<sup>8,9</sup> but other studies suggest that intakes of 1200–1500 mg may slow the rate of bone loss in the forearm or hip. While intakes of this order may be beneficial to some degree, and safe for most individuals, present evidence is not strong enough to recommend these intakes for everyone.



#### 4 Postmenopausal women, or men with osteoporosis

Increasing calcium intake in patients with established osteoporosis appears to have relatively little effectiveness as a sole treatment for osteoporosis. The main importance of calcium is in prevention. Osteoporosis treatment regimes should be planned by physicians and should include medications, exercise, and a diet containing adequate amounts of calcium and other nutrients. The interaction between calcium intake and agents used to treat osteoporosis such as sodium fluoride, estrogens, and vitamin D analogues requires further study, as does the interaction between calcium intake and exercise.

#### 5 Other groups with special requirements

Although exact requirements cannot be stated, patients taking glucocorticoid drugs or large amounts of antacid preparations containing aluminum will require intakes of calcium significantly higher than those recommended for the general public. It is possible that postmenopausal women and the elderly have higher requirements than are presently recommended, but further study is necessary on this point. Lack of physical activity is very likely to be the major negative factor for bone health in the elderly. Patients with diseases of the intestinal tract or kidney may have increased calcium requirements.

#### Nutritional and lifestyle factors affecting calcium economy

Modification of diet and lifestyle may be necessary in order to maximize calcium utilization and bone health. Several dietary components are known to affect calcium absorption and utilization. Vitamin D promotes absorption and utilization of ingested calcium. Factors which have a negative effect include excessive intakes of protein, caffeine (in coffee, tea, and soft drinks), oxalate, and fibre. There is no evidence that dietary magnesium has any significant effect on calcium and bone metabolism in healthy individuals consuming a normal diet. Lifestyle factors known to have negative effects on bone health include lack of exercise, smoking, and consumption of alcohol. The recent recommendation of Health and Welfare Canada for a significant increase in intake of dietary fibre further emphasizes the need to ensure an adequate calcium intake according to the guidelines. The estrogen status of females also affects their calcium requirements. Amenorrhoeic or estrogen-deficient females will require greater amounts of calcium than those with normal estrogen levels. Postmenopausal females taking estrogen supplements probably do not require any more calcium than normal premenopausal women.<sup>10</sup>

#### Possible toxic effects of high calcium intake

For most Canadians it is safe to consume recommended dietary intakes of calcium, or supplemented intakes up to 1500 mg. Some individuals, however, may suffer adverse effects from high calcium intakes, especially those who have had kidney stones, and those with abnormalities of calcium metabolism. There is little information regarding the long-term safety of habitual intakes above 2000 mg/day. The Society recommends

that individuals consult their physicians before increasing their habitual calcium intakes above recommended levels. Measurement of the calcium concentration in blood and urine can detect many individuals who would be adversely affected by increased calcium intake.

#### References

- 1 Written by T.M. Murray, M.D., F.R.C.P.(C). A multidisciplinary panel considered all aspects of this problem at a one-day Workshop held under the auspices of the Osteoporosis Society of Canada, in Winnipeg, Manitoba, on September 10, 1987. This document represents the consensus opinion of the panel. Panel members were: Dr. J.D. Adachi, McMaster University; Dr. J. Andreyko, University of Toronto; Dr. E. Bright-See, Ludwig Cancer Institute, Toronto; Dr. E.C. Cameron, University of British Columbia; Dr. R. Crilly, University of Western Ontario; Dr. P. D'Amour, University of Montreal; Dr. W.J. Dubé, University of Manitoba; Dr. D. Hanley, University of Calgary; Dr. J.E. Harrison, University of Toronto; Dr. J.N.M. Heersche, University of Toronto; Dr. R.G. Josse, University of Toronto; Dr. T.M. Murray, University of Toronto; Dr. M. Kaye, McGill University; Dr. L.-G. Ste.-Marie, University of Montreal; Dr. W.C. Sturtridge, University of Toronto.
- 2 Approved by the Board of Directors of the Osteoporosis Society of Canada on October 27, 1987.
- 3 Health and Welfare Canada. Recommended nutrient intakes for Canadians, 1983.
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- 5 Picard D, Ste.-Marie L.-G., et al. In *Calcium Regulation and Bone Metabolism: Basic and Clinical Aspects*, v.9, DV Cohn, TJ Martin, PJ Meunier, eds. 1987, p128.
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Osteoporosis is associated with significantly reduced quality of life for many Canadians over the age of 60. It's estimated that close to one million adult Canadians suffer from this condition. With increasing numbers of senior citizens, health care issues and costs associated with osteoporosis can only continue to escalate.

The objectives of the Osteoporosis Society of Canada are to provide information both to the public and health professions and to support relevant research into the causes, prevention and effective treatment of osteoporosis.

This position paper was originally approved on October 27, 1987. While the official position of the Osteoporosis Society and the Medical Advisory Board remains unchanged, readers may wish to review current literature to support their knowledge.