Osteoporosis Prevention: Dietary Strategies

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Osteoporosis: a major health burden

- Currently some 2 million Australians have been diagnosed with osteoporosis; every 5 to 6 minutes someone is admitted to hospital with an Osteoporotic fracture.
- 25% of patients with a hip fracture die within 12 months and 50% do not regain their original mobility; all fracture patients have increased mortality.
- Direct costs to our community amount to $1 billion/yr and indirect costs possibly amount to a further $6 billion/yr.
Osteoporosis and fractures are mainly associated with the effects of ageing.

Can we modify these effects?
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Can we modify these effects?

Yes!!
A Spinal Fracture shown by X-ray
A hip fracture is the most serious of all fractures
Osteoporosis: a silent disease

• Up to 90% of patients with fragility fractures of the spine, forearm or hip remain undiagnosed and untreated for osteoporosis

• Osteoporosis accounts for only 0.6% of medical conditions managed by General Practitioners
Patients with Fractures are more likely to die at a younger age than the General Population

Bliuc, D. et al. JAMA 2009;301:513-521

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Effective treatments are available to reduce the risk of fracture

• Fracture risk is markedly reduced by drugs. Vertebral fractures reduced by 40 to 70%. Non-vertebral fractures reduced by 12 to 36%.

• Importantly these treatments for osteoporosis reduce the increased rate of deaths.

After 5 years of treatment the death rate is returned to the general population level.
Do we have evidence for measures to prevent Osteoporosis?

• Adequate dietary calcium - how much?
• Adequate vitamin D status - how much?
• Exercise - to be discussed next

• Limit alcohol to 2 drinks per day
• No smoking
• A healthy lifestyle will improve your bones as well as make you feel better
What is Osteoporosis?

Young Healthy Bone

Osteoporotic Bone
What is Osteoporosis?

“Too little bone in the bone”

Young Healthy Bone

Osteoporotic Bone
What is Osteoporosis?

So what can we do about it?
The Chemical Constituents of Bone

- A scaffolding of proteins, largely a special bone collagen. We require vitamin C for healthy collagen.
- The bricks are made up of calcium and phosphate which crystallise along the collagen strands.
- To provide strength bone has flexibility from the collagen and rigidity from the calcium phosphate crystals.
Calcium is an Essential Nutrient (1)

We need an adequate amount in our blood to ensure appropriate nerve and muscle activity including our heart and lungs.

We lose calcium in our urine, bowel and skin every second of the day and night.
Calcium is an Essential Nutrient (2)

- Our bones are our 'calcium bank'
- If we don’t eat sufficient calcium everyday then we withdraw calcium from our 'bank'
- At some stage there is too little in the bank to keep our bones intact and they break
Osteoporosis is the index disease of Dietary Calcium Deficiency

Scanning Electron Micrographs of rat distal femora fed low and normal calcium diets

Low Diet Calcium

Normal Diet Calcium

Scans by Dr Paul Baldock
Higher total dietary calcium intake reduces bone loss in calcium-treated (filled circles) and non-treated (empty circles) women.
How much calcium do we need each day?

<table>
<thead>
<tr>
<th>Adults</th>
<th>EAR</th>
<th>RDI</th>
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<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19–30 yr</td>
<td>840 mg/day</td>
<td>1,000 mg/day</td>
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<tr>
<td>31–50 yr</td>
<td>840 mg/day</td>
<td>1,000 mg/day</td>
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<tr>
<td>51–70 yr</td>
<td>840 mg/day</td>
<td>1,000 mg/day</td>
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<tr>
<td>&gt;70 yr</td>
<td>1,100 mg/day</td>
<td>1,300 mg/day</td>
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<tr>
<td>Women</td>
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NHMRC Nutrient Reference Values for Australia and New Zealand, 2005
How many elderly women are consuming adequate dietary calcium?

<table>
<thead>
<tr>
<th></th>
<th>Current study (2007)</th>
<th>1995 NNS</th>
<th>EAR for age &gt;70 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>age 74.2 ± 2.7 years</td>
<td>age ≥65 years</td>
<td>for age &gt;70 years</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>(Mean)</td>
<td>(Mean)</td>
<td>(Mean)</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>852 ± 298</td>
<td>686</td>
<td>1100</td>
</tr>
</tbody>
</table>

X Meng, DA Kerr, Kun Zhu, A Devine, V Solah, C W Binns RL Prince
Calcium Intake in Elderly Australian Women Is Inadequate Nutrients 2010, 2(9), 1036-1043; doi:10.3390/nu2091036

Only 25% of elderly Australian women consume an adequate dietary calcium intake
What are the dietary sources of calcium?

- Dairy products are a rich source of calcium.
  - Skim Milk contains about 1.4 mg/ml
  - Yoghurt about 1.7 mg/gm
  - Cheese about 8 mg/gm
- Calcium is present in many other foods supplying ~400 mg/d.
- Dairy or a supplement is needed to reach the target.
Vitamin D is also important for the calcium economy and for bone strength

- Vitamin D is not a vitamin but a precursor of a hormone
- When activated in the body it stimulates absorption of dietary calcium and acts to maintain blood calcium levels within range
- New research has established that vitamin D is also activated by cells in bone to help build bone
Vitamin D arises almost entirely from sunshine exposure.

Not too much of course because it causes skin cancer. 5 to 10 minutes per day is recommended but don't forget the sunscreen for longer times.
Vitamin D and Sunlight in Adelaide, 1982

SERUM 25 OH-VITAMIN D (nmol/l)

AMBULANT SUBJECTS

NURSING HOME SUBJECTS

(1983)

HIP FRACTURE PATIENTS

• p < 0.05
•• p < 0.01

compared with February

AVERAGE DAILY HOURS OF SUNSHINE

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC

Vitamin D and Calcium Prevent Hip Fractures in Elderly Women

Chapuy et al. NEJM 1992
Relative Risk of Fracture versus Achieved Vitamin D Levels in Randomised Control Trials

Hip Fracture

Non-vertebral Fracture

Bischoff-Ferrari et al Am J Clin Nutr 2006;84:18-28
Vitamin D status of Perth, WA Red Cross blood donors in 1999

Summary:

- Some three-quarters of elderly Australian men and women have inadequate dietary calcium intakes and vitamin D status.
- Current protocols for supplementation or appropriate foods have poor compliance and poor uptake.

Would suitably supplemented food products that meet these requirements be attractive to consumers?
Vision:

• For the health care professions to reach agreement on a single Osteoporosis Prevention public health message
• For individuals to hear the message and act to optimise their health
• For our supermarkets to be stocked with a variety of calcium and vitamin D enriched products in the form of drinks, yoghurt and snack bars
What can we achieve?

• Maintain our mobility and ability to live independently until an older age

• Save billions of health care dollars to be invested in other health areas
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- Maintain our mobility and ability to live independently until an older age
- Save billions of health care dollars to be invested in other health areas

Thankyou