Vitamin D and Calcium: Role in Prevention and Treatment of Fractures and Falls

Osteoporosis 2010: New Insights In Research, Diagnosis, and Clinical Care

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29 studies, 63,897 participants
- 92% women
- age 67.8 ± 9.7 years
- 17 reported fracture, 24 reported BMD
- 13 trials calcium + vitamin D

Bone loss
- ↓ 0.54% (0.35 – 0.73) hip
- ↓ 1.19% (0.76 – 1.61) spine

Meta-analysis of calcium +/- vitamin D

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Type of fracture
- Calcium alone vs. calcium + vitamin D
- Gender

Meta-analysis of calcium +/- vitamin D

<table>
<thead>
<tr>
<th>Study</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapuy-1</td>
<td>0.75 (0.64-0.87)</td>
</tr>
<tr>
<td>Reid</td>
<td>0.40 (0.35-1.08)</td>
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<tr>
<td>Chevalley</td>
<td>0.58 (0.33-2.66)</td>
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<tr>
<td>Recker</td>
<td>0.85 (0.56-1.30)</td>
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<tr>
<td>Dawson-Hughes</td>
<td>0.46 (0.23-0.90)</td>
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<tr>
<td>Riggs</td>
<td>0.89 (0.51-1.57)</td>
</tr>
<tr>
<td>Peacock</td>
<td>0.81 (0.46-1.43)</td>
</tr>
<tr>
<td>Chapuy-2</td>
<td>0.85 (0.64-1.13)</td>
</tr>
<tr>
<td>Lassen</td>
<td>0.84 (0.72-0.98)</td>
</tr>
<tr>
<td>Harwood</td>
<td>0.49 (0.03-7.87)</td>
</tr>
<tr>
<td>Fujita</td>
<td>0.31 (0.07-1.39)</td>
</tr>
<tr>
<td>RECORD-1</td>
<td>0.94 (0.77-1.19)</td>
</tr>
<tr>
<td>Porthouse</td>
<td>0.98 (0.73-1.33)</td>
</tr>
<tr>
<td>RECORD-2</td>
<td>0.94 (0.77-1.15)</td>
</tr>
<tr>
<td>Jackson</td>
<td>0.97 (0.92-1.03)</td>
</tr>
<tr>
<td>Reid-2</td>
<td>0.92 (0.75-1.14)</td>
</tr>
<tr>
<td>Prince-1</td>
<td>0.87 (0.69-1.10)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.94 (0.85-1.03)</td>
</tr>
</tbody>
</table>

12% reduction in fracture risk, p=0.0004
Factors associated with higher effect

- Baseline low 25-OH vitamin D (< 10 ng/mL)
- Baseline calcium intake < 700 mg/day
- Institutionalized vs. community dwellers
- Age > 70 years
- Higher adherence
- Calcium doses > 1200 mg
- Vitamin D doses > 800 IU

Calcium and Vitamin D vs. Vitamin D

- 7 vitamin D trials US, Europe, >1000
- 68,500 study participants
- Age 69.9, 14.7% men

BMJ. 2010 Jan 12;340:b5463. doi: 10.1136/bmj.b5463

Effect on falls by dose and 25 OH D level

Annual high dose vitamin D

Bischoff-Ferrari, et. al. BMJ. 2009 Oct 1;339:b3692. doi: 10.1136/bmj.b3692

Serum 25 OH vitamin D levels

- Current recommendations
  - up to age 50: 1000 mg/day
  - ages 51+: 1200-1500 mg/day
  - maximum: 2500 mg/day
- Threshold nutrient — ↑17% kidney stones in WHI
- Labels based on 1000 mg
  - 3% = 30 mg
  - 25% = 250 mg

Calcium

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Calcium

- Active and passive absorption throughout small intestine
- Max intake at once ~ 500 mg
- Diet w/no calcium rich foods = 250 mg calcium
- Interferes with iron, thyroid hormone absorption
- Caffeine
  - OK in moderation with adequate calcium intake
- Soda
- Dairy foods
- Lactose Intolerance: hard cheeses, lactase treated dairy products
- Fortified cereal, OJ, cereal bars, soy/rice milk
- Tofu
- Dark green leafy vegetables—broccoli, cabbage, brussel sprouts, mustard greens
- http://www.dairycouncilofca.org "Calcium Quiz"

Calcium Supplements

- Citrate vs. Carbonate
- Coral calcium = calcium carbonate
- USP verified
- Chewable — Viactiv, GNC, Tums
- Vitamin D
  - sufficient → calcium absorp = 30%
  - insufficient → calcium absorp = 10%

Vitamin D

- Prevalence of vitamin D deficiency
  - 50% elderly hip fx patients
  - 67% of inpatients > age 65
  - 42% premenopausal African American women
  - 4%-5% premenopausal Caucasian women
  - 57% interns/residents in Brazil

- Current recommendations:
  - up to age 50: 200 IU/day
  - ages 51-70: 400 IU/day
  - ages 71+: 600 IU/day
  - maximum: 2000 IU/day
**Vitamin D Therapy**

- All osteoporosis therapeutic trials conducted with calcium/vitamin D
- Mixed results in literature
  - Lower doses
  - More replete populations
  - Poor adherence
  - Effects of intermittent dosing
- Target serum level = > 32 ng/mL
- Probably need > 800 IU/day
- 10,000 IU/day no adverse effects, 25-OH D levels ~ 90 ng/mL

**Sources of vitamin D**

- Sunshine: 20 minutes/day, 6% body surface
- Food
  - Milk 100 IU/glass
  - Cod liver oil: 453 IU/teaspoon
  - Tuna in fish oil: 170 IU/ 1/2 cup
  - Egg: 26 IU/large egg
- Supplements
  - Multivitamin: 200-400 IU +
  - GNC—D3: 1,000, 2,000
    - liquid (100 IU/drop), gummy (1,000 IU)
    - D3: 1,000, 5,000 (2600 IU), 50,000 (30,000) IU
Summary

• Calcium: 1200 mg/day—diet + supplements
• Vitamin D: 1200 IU/day
• Be alert for conditions that might need more
  – malabsorption (gastric bypass)
  – healing osteomalacia
  – fracture healing
  – anabolic therapy
  – adolescence
  – post operative hyperparathyroid
  – hypoparathyroid