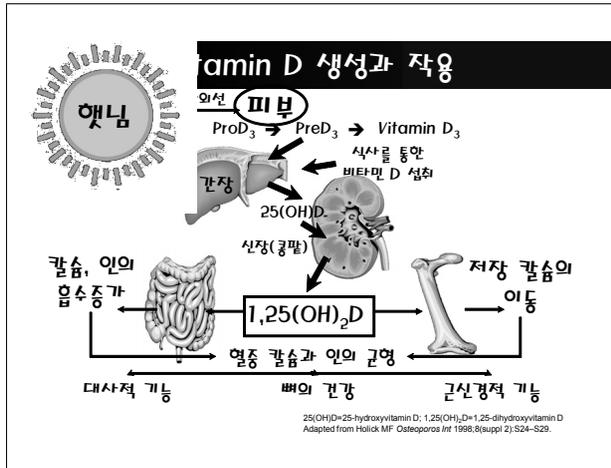


소강당

칼슘의 역할

오한진

관동의대 제일병원 가정의학과



Calcium (Ca⁺⁺)

- **칼슘**
역치 영양소 (threshold nutrient)
필요한 양보다 적게 섭취 → 골량 감소
필요이상 섭취증가 → 추가적인 이익 없다.
- **Vitamin D**
부족경우 → 섭취 칼슘의 10~15% 흡수
충분경우 → 흡수가 30~40%로 증가

Calcium

한국인의 1일 칼슘 권장량

| 연령 | 여자(mg) | 남자(mg) |
|-------|--------|--------|
| 6-8 | 700 | 700 |
| 9-11 | 800 | 800 |
| 12-19 | 900 | 1,000 |
| 20-49 | 700 | 700 |
| >50 | 800 | 700 |
| 임신부 | +300 | |
| 수유부 | +400 | |

2005년 한국영양학회



한국인 칼슘 섭취량

- 한국인 평균 칼슘 섭취량
권장량의 63.4%
(단백질 142.9%, 인 149%)
- 모든 연령에서 권장량의 75% 미만 섭취
- 칼슘 요구량이 높은 군 → 낮은 칼슘 섭취
12-18세 청소년
65세 이상 노인
→ 노인 섭취량: 권장량의 50% 미만

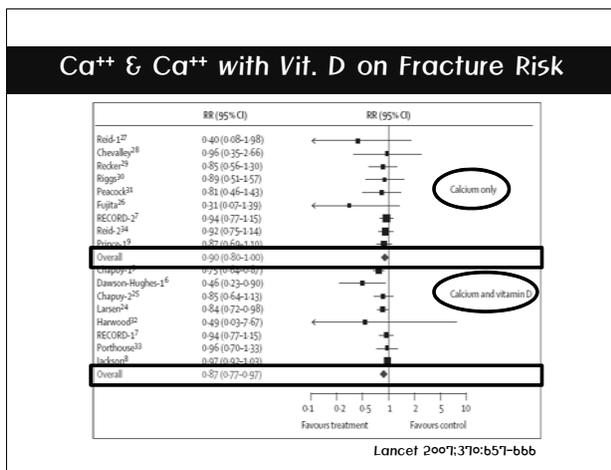
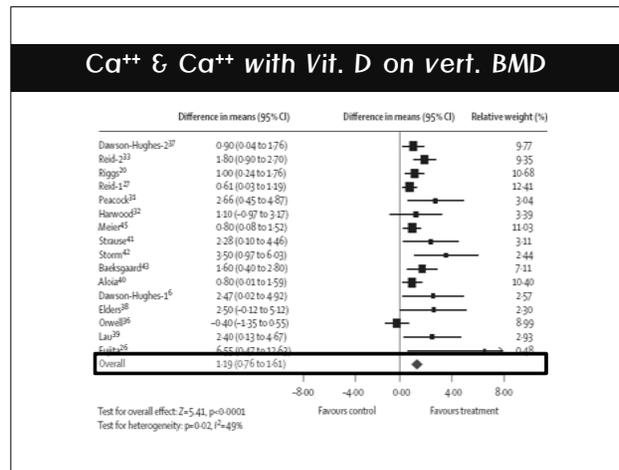
2007년 국민영양조사 (제4기)

Calcium Supplementation

| | |
|----------------|---|
| ● Ca carbonate | ✓ Most common cost effective form ✓ With meal for optimal absorption |
| ● Ca citrate | ✓ taken without food ✓ Choice with achlorhydria or taking H ₂ blocker, PPI |
| ● Ca lactate | ✓ Less concentrated form |
| ● Ca gluconate | |

Calcium Supplementation

| | Calcium salt vitamin D | Total dose | Elemental calcium |
|-------------|---------------------------|---------------|----------------------|
| Dicamax® | Ca carbonate | 1250mg | 500mg (40%) |
| | Cholecalciferol | 1000IU | |
| Cal-D-vita® | Ca carbonate | 1500mg | 600mg (40%) |
| | Cholecalciferol | 400IU | |
| Oscal® | Ca carbonate | 500mg | 200mg (40%) |
| | Cholecalciferol | 400IU | |
| Calteo80® | Ca citrate | 1500mg | 360mg (24%) |
| | cholecalciferol | 800IU | |



- ### New Issues & Adverse Effects of Ca⁺⁺
- Gastrointestinal SE**
 - constipation, gas,
 - flatulence, bloating
 - ca carbonate; mc
 - Renal calculi**
 - low ca diet
→ risk of kidney stones ↑
 - excess ca intake
→ renal calculi risk ↑
 - Cardiovascular events**
 - not conclusive

Ca⁺⁺ & Renal Calculi

- Ca 섭취 증가
ca 흡수 증가, 소변으로 ca 배출 증가
ca이 장내에서 oxalate와 결합
oxalate absorption을 억제
→ urine oxalate 를 감소시킴
→ 결석 형성 위험 감소
- Low ca diet
→ 장에서 oxalate absorption이 증가
urine oxalate가 증가
→ 결석 형성 위험이 증가
- High ca diet
→ ca과 oxalate가 완전히 결합
더 이상의 urine oxalate 감소 없다
→ urine ca 만 증가시킬 수 없음.

Ca⁺⁺ & Renal Calculi

1. WHI study
50~79 years/ 36,282 PM5 women
ca 1000mg + vit D₃ 400 IU or placebo
F/U for 7 years, 2.47% vs. 2.1%
→ Risk of renal calculi: HR 1.71
2. Nurse Health study II
27~44 years/ 96,245 young women
8 yrs follow up
kidney stone vs. dietary ca intake
→ highest quintile 27% risk ↑
3. Taylor EN et al.
45,619 men/ 14 yrs f/u ; 1,473 stone (+)
< boys: highest quintile ; risk 31% ↓
≥ boys: similar risk

Ca⁺⁺ & CVD Risk; WHI Study

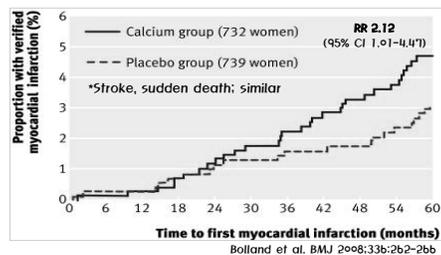
36,282 postmenopausal women, 7yr F/U

| | Calcium/Vitamin D (N=18 176, n (Annualized %) | Placebo (N=18 106), n (Annualized %) | Hazard Ratio (95% CI) | P |
|--|---|--|--------------------------|------|
| Myocardial infarction or CHD death | 499 (0.39) | 475 (0.37) | 1.04 (0.92-1.18) | 0.50 |
| Myocardial infarction | 411 (0.32) | 390 (0.31) | 1.05 (0.91-1.20) | 0.52 |
| CHD death | 130 (0.10) | 128 (0.10) | 1.01 (0.79-1.29) | 0.92 |
| CABG or PCI | 674 (0.53) | 607 (0.48) | 1.09 (0.98-1.22) | 0.12 |
| Myocardial infarction/CHD death/CABG/PCI | 920 (0.72) | 841 (0.66) | 1.08 (0.99-1.19) | 0.10 |
| Confirmed angina | 404 (0.32) | 377 (0.30) | 1.08 (0.94-1.24) | 0.30 |
| Hospitalized heart failure | 394 (0.31) | 407 (0.32) | 0.95 (0.83-1.10) | 0.50 |
| Stroke | 362 (0.28) | 377 (0.30) | 0.95 (0.82-1.10) | 0.51 |
| Ischemic stroke | 225 (0.18) | 228 (0.18) | 0.98 (0.82-1.18) | 0.84 |
| Hemorrhagic stroke | 58 (0.05) | 68 (0.05) | 0.84 (0.59-1.19) | 0.33 |
| Other stroke | 63 (0.05) | 57 (0.04) | 1.11 (0.77-1.59) | 0.58 |
| Transient ischemic attack | 213 (0.17) | 182 (0.14) | 1.16 (0.95-1.42) | 0.13 |
| Stroke/transient ischemic attack | 563 (0.44) | 547 (0.43) | 1.02 (0.91-1.15) | 0.75 |

WHI investigators. Circulation 2007;115:846-854

Ca⁺⁺ & CVD Risk

- ✓ Randomized placebo controlled trial, in New Zealand
- ✓ 1,471 healthy PM5 women (mean age 74)
- ✓ 732 ca supp, 739 placebo - 5yr F/U



Bolland et al. BMJ 2008;336:262-266

Ca⁺⁺ & CVD Risk; NOF Recommendation

- Providing adequate daily calcium and vitamin D is a safe and inexpensive way to help reduce fracture risk.
- Women older than age 50 consume at least 1,200 mg per day of elemental calcium.
- Intakes of excess of 1,200 to 1,500mg per day have limited potential for benefit and may increase the risk of developing kidney stones or cardiovascular disease.

Ca and CVD risk



American Society for Bone and Mineral Research
Statement on Potential Cardiovascular Risks Associated with Calcium Supplements

August 12, 2010

A recent report suggesting link between calcium supplements and an increased risk of cardiovascular events has sparked concern amongst patients, health care professionals and the public. In response to these concerns, the ASBMR has reviewed the current available literature. Some analyses have suggested a possible increase in risk while others have not provided evidence of increased risk. Until further studies are done and more information is available, the ASBMR advises that anyone taking or considering taking calcium supplements be aware of the following key points:



Ca and Vit-D; CVD risk

Key Points

- 1) There are numerous large studies of calcium plus vitamin D that have shown no increased risk of cardiovascular events.
- 2) Persons currently taking calcium supplements should not necessarily discontinue their use. Rather, they should discuss the decision to use these agents with their health provider, and understand that food remains the best source of calcium. Supplements should be used only when adequate dietary intake of calcium cannot be achieved.
- 3) The beneficial effects of calcium are found with relatively low doses. More is not necessarily better. Individuals should discuss the amount of their calcium intake with their health provider.
- 4) In almost every modern study of osteoporosis treatment, adequate calcium and vitamin D were required for medications to have anti-fracture efficacy.
- 5) Elderly individuals and others with impaired renal (kidney) function who take calcium supplements may be at higher risk of cardiovascular problems.

The U.S. Food and Drug Administration (FDA) has begun a safety analysis on calcium supplements. The ASBMR will continue to study this important clinical issue and release additional information at such time that it is available.

비타민 D와 칼슘의 낙상 감소효과; 49%

- 122 여성
- 연령: 63-99 세
- 이중맹검 대조군 연구
- 칼슘 1200 mg/day
- 칼슘 1200 mg/day + vitamin D 800 IU/day
- 실험기간: 12주
- 평균 혈중 25(OH)D 시작시: 12 ng/ml
- 장기 요양시설 거주자

Adapted from Bischoff HA et al. J Bone Miner Res 2003;18:343-351.

RESEARCH

Effect of calcium supplements on risk of myocardial infarction and cardiovascular events: meta-analysis

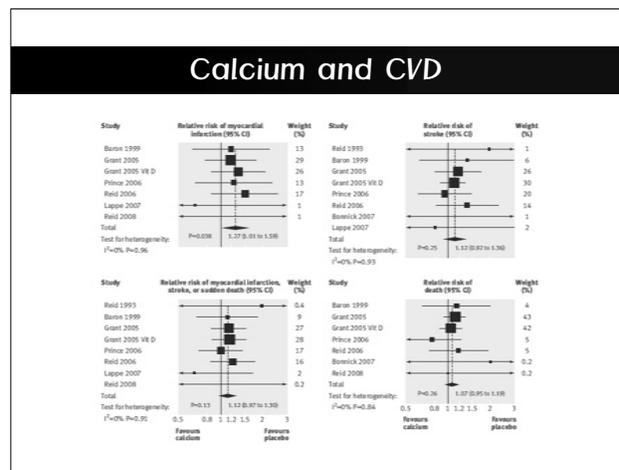
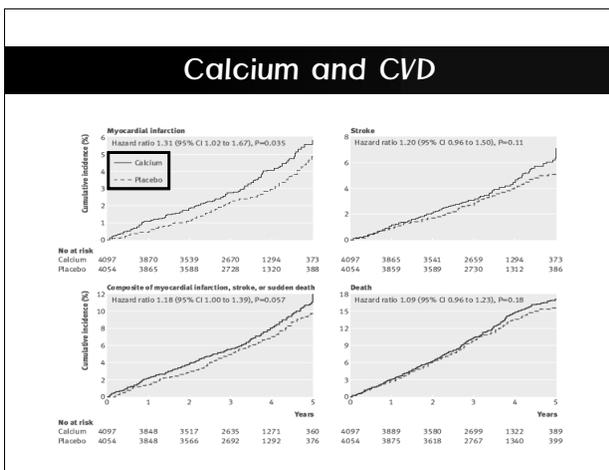
Mark J Bolland, senior research fellow,¹ Alison Avenell, clinical senior lecturer,² John A Baron, professor,³ Andrew Grey, associate professor,⁴ Graeme S MacLennan, senior research fellow,⁵ Greg D Gamble, research fellow,⁶ Ian R Reid, professor⁷

CVD and Death by treatment

Table 3 | Number of people with cardiovascular events and deaths by treatment allocation

| Studies | Calcium group | | | | | Placebo group | | | | |
|-----------------------------|--------------------|-----------------------|------------|------------|------------|--------------------|-----------------------|------------|------------|------------|
| | No of participants | Myocardial infarction | Stroke | Composite* | Death | No of participants | Myocardial infarction | Stroke | Composite* | Death |
| Dawson-Hughes ¹⁴ | 238 | 0 | 0 | NA | NA | 123 | 0 | 1 | NA | NA |
| Reid ¹⁵ | 68 | 0 | 2 | 2 | 0 | 67 | 0 | 1 | 1 | 0 |
| Riggs ¹⁶ | 119 | 0 | 0 | 0 | 1 | 117 | 0 | 0 | 0 | 0 |
| Baron ¹⁷ | 466 | 20 | 15 | 31 | 25 | 466 | 17 | 11 | 28 | 22 |
| Bonithon-Kopp ¹⁸ | 204 | 0 | 1 | 1 | 8 | 212 | 0 | 0 | 1 | 9 |
| Grant ¹⁹ | 1311 | 45 | 56 | 97 | 238 | 1332 | 39 | 48 | 86 | 217 |
| Grant ²⁰ | 1306 | 44 | 60 | 100 | 220 | 1343 | 34 | 58 | 89 | 218 |
| Reid ¹⁵ | 732 | 31 | 34 | 60 | 34 | 739 | 21 | 25 | 50 | 29 |
| Prince ²¹ | 730 | 21 | 38 | 56 | 29 | 730 | 17 | 40 | 56 | 38 |
| Bornick ²² | 282 | 0 | 1 | NA | 2 | 281 | 0 | 2 | NA | 1 |
| Lappe ²³ | 446 | 2 | 5 | 8 | NA | 288 | 2 | 4 | 8 | NA |
| Reid ¹⁵ | 216 | 3 | 0 | 3 | 3 | 107 | 0 | 0 | 0 | 1 |
| Total | 6116 | 166 | 212 | 358 | 559 | 5805 | 130 | 190 | 319 | 535 |

NA=not available.





Summary

- Combined Supply (Ca + Vit-D)
 - Reduce Fracture
- Ca alone , or Vit-D alone
 - Did not reduce Fracture
- Calcium without Vit-D
 - Increase MI
 - Vascular effects needed to study
 - Magnitude of increase → modest
 - Need large scale study