Prevention and Management of Osteoporosis

Question 1
Which of the following is a benefit of physical activity relative to bone health?
A. Augments peak bone mass in children and adolescents
B. Preserves BMD in adults
C. Prevents falls
D. All the above

Question 2
What is the recommended daily intake of calcium for people > 70 yo?
A. 1,000 mg
B. 1,200 mg
C. 1,500 mg
D. 2,000 mg
Question 3
What is the recommended daily intake of vitamin D for those between 50 & 70 yo?
A. 200 IU
B. 300 IU
C. 400 IU
D. 600 IU

Question 4
What percent of women over the age of 85 fall each year?
A. 10%
B. 24%
C. 48%
D. 58%

Question 5
Which of the following contains the greatest quantity of calcium per serving?
A. Milk
B. Cheddar cheese
C. Salmon
D. Spinach
Instructions

While viewing this multi-media program, you can control the slides and audio by using the “play”, “pause”, “next”, and “previous” controls.

You can also jump to a specific slide using the thumbnail images at the bottom of the screen.

Learning Objectives

At the conclusion of this program participants should be able to:

- Explain the primary goals for the management of osteoporosis
- Describe the behavioral/lifestyle modifications for the prevention and management of osteoporosis and fractures including smoking cessation, physical activity, nutritional strategies and fall prevention
- Develop individualized prevention plans for patients
- Educate patients on the implementation of their prevention plans

Wendy Rosenthal, PharmD

- BS in Pharmacy from the University of Georgia and Doctor of Pharmacy from the Medical University of South Carolina
- Currently the President of MedOutcomes, Inc.
- Spoken nationally on osteoporosis and written a number of articles on the subject

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Lifestyle Changes: General Preventive Strategies

Primary Goals of Therapy
- Increase bone mass
- Stop or reverse bone loss
- Reduce the potential incidence of osteoporotic fracture
- Maintain or improve quality of life

The Osteoporosis Pyramid

Pharmacotherapy
Identify and Address Secondary Causes
Lifestyle Changes
Individuals can promote their own bone health beginning in childhood and continuing into old age.

General Preventive Strategies

- Smoking Cessation

General Preventive Strategies

- Physical Activity
  - Benefits:
    - Maintain BMD
    - Prevent falls
    - Improves gait
    - Balance
    - Coordination
    - Reaction time
    - Muscle strength
Physical Activity

- Type of exercise
  - Load-bearing
  - Variety of loading patterns
  - Stimulus must exceed the usual load

Impact of Physical Activity on Bone Health

- Benefits of weight-bearing exercise are site specific
  - BMD improvements occur only at site receiving impact of the exercise

Impact of Physical Activity on Bone Health

- Effects on bone health are age specific
  - Children & Adolescents: augment peak bone mass
  - Adults: preserve BMD

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Weight-bearing physical activity for bone health does not have an upper age limit. But as age increases so does the need for ensuring that physical activities can be performed safely.

Impact of Physical Activity on Bone Health

- Benefits persist only as long as the activity continues
  - BMD will return to preactivity level
  - Physical activity should be a lifelong endeavor

Impact of Physical Activity on Bone Health

- Benefits appear greater in those less active at baseline
Impact of Physical Activity on Bone Health

- Complete lack of activity causes bone loss
  - Avoid or minimize immobility

Position Stand of Am College of Sports Med: Physical Activity & Bone Health

- Exercise prescription for children & adolescents
  - **Mode**: Impact activities, such as gymnastics & jumping, & moderate intensity resistance training; participation in sports that involve running & jumping
  - **Intensity**: high in term of bone-loading force
  - **Frequency**: at least 3 days weekly
  - **Duration**: 10 to 20 minutes each workout

- Exercise prescription for adults
  - **Mode**: weight-bearing endurance activities, activities that involve jumping & resistance exercise that targets all major muscle groups
  - **Intensity**: moderate to high bone-loading force
  - **Frequency**: weight-bearing endurance activities = 3 – 5 times weekly; resistance exercise = 2 – 3 times weekly
  - **Duration**: 30 – 60 minutes
Exercise for Maximization & Maintenance of Bone Mass

- Must be tailored to the individual’s overall physical ability and general medical health

Exercise for Maximization & Maintenance of Bone Mass

- Recognize personal barriers to exercise
  - Lack of discipline
  - Lack of time
  - Lack of knowledge
  - Lack of proper conditions

“You don’t stop exercising because you grow old. You grow old because you stop exercising.”
- Anonymous
Calcium

General Preventive Strategies

- Calcium Intake
  - Most abundant mineral of the body
  - Source = food products

Calcium

Functions
- Provides strength and support to the skeleton
- Assists in
  - Nerve impulse transmission
  - Muscle contraction
  - Enzyme regulation
  - Stimulation of hormone and neurotransmitter release
  - Blood clotting and numerous other biochemical processes
Calcium Homeostasis

- ↓ Serum Calcium
- Stimulation of Parathyroid Glands
- Parathyroid Hormone
  - Promotion of Vitamin D Activation
  - Increase in Calcium Reabsorption in Renal Tubule
  - Bone Resorption
  - Calcium Absorption in GI Tract
- ↑ Calcium Release

Effects of Aging on Calcium Balance

- Estrogen deficiency causes impaired intestinal and renal calcium absorption
- Decreased GI absorption due to reduced gastric acid production
- Reduced dietary consumption
- Increased immobilization

KEY POINT

The body will preferentially extract skeletal calcium to maintain an adequate homeostatic supply at the expense of skeletal integrity.
It is estimated that 3 out of 4 Americans do not meet the RDA for calcium.

**Calcium**

- **Efficacy**
  - Can slow rate of bone loss and may decrease fractures
  - Most effective in:
    » Preventing cortical bone loss
    » Women with lowest intake
    » Women before or after 1st 5 years of menopause

**Calcium**

- **Patient Selection**
  - Age
    » Important at all ages
  - Adjunct to drug therapy
Calcium

- Contraindications
  - Hypercalciuria
  - Kidney stones ????

Comparison of Two Diets for Prevention of Recurrent Stones in Idiopathic Hypercalciuria

*NEJM 2002;346:77-84*

- **Patient Population:** 120 men with recurrent calcium oxalate stones & hypercalciuria
- **Therapy:** low calcium diet (400mg/day) or normal calcium diet (1,200mg/day); 5 year study
- **Results:** 12 (20%) men on normal calcium diet and 23 (38%) on low calcium diet had recurrences of stones

What Is Going On?

- **Low calcium diet:**
  - Decreases urinary excretion of calcium
  - Increases urinary excretion of oxalate
    - Due to increased absorption of oxalate in intestines
    - Dietary calcium binds with dietary oxalate in the intestines to form insoluble, nonabsorbable complex
- **Normal calcium diet:**
  - More calcium is available in intestines to bind oxalate
  - This reduces oxalate absorption & urinary excretion
Approach To Optimizing Calcium Intake

- Determine actual average daily intake
- Determine adequate daily calcium intake
- Select food sources to meet calcium requirement
- Select calcium supplement

1. Determine Actual Average Daily Intake

- Dairy products
- Select fish and vegetables
- Calcium-fortified cereals & orange juice

Reading Food Labels

- Generally list the percentage of the RDA found in the stated serving size
- Based on a RDA of **1,000 mg**
- Example: skim milk
  - Serving size of 1 cup contains 35% of the RDA
  - 35% of 1,000 mg = 350 mg of calcium
2. Determine Adequate Daily Calcium Intake

- No universal standard
- NOF: All individuals should intake at least 1,200 mg of elemental calcium daily

Recommended Daily Intake (RDI) for Elemental Calcium Infant to Adolescent

<table>
<thead>
<tr>
<th>AGE</th>
<th>RDI (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td></td>
</tr>
<tr>
<td>0-6 months</td>
<td>400</td>
</tr>
<tr>
<td>6 months – 1 year</td>
<td>600</td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>1-5 years</td>
<td>800</td>
</tr>
<tr>
<td>6-10 years</td>
<td>800 – 1,200</td>
</tr>
<tr>
<td>Young adults</td>
<td></td>
</tr>
<tr>
<td>11-24 years</td>
<td>1,200 – 1,500</td>
</tr>
</tbody>
</table>

3. Select Food Sources to Meet Calcium Requirement

<table>
<thead>
<tr>
<th>Food Source</th>
<th>Calcium Content (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, dry whole</td>
<td>320-500</td>
</tr>
<tr>
<td>Milk, whole</td>
<td>1 cup</td>
</tr>
<tr>
<td>Yogurt, plain</td>
<td>1 cup</td>
</tr>
<tr>
<td>Yogurt, with fruit</td>
<td>1 cup</td>
</tr>
<tr>
<td>Canned cheese</td>
<td>1 oz</td>
</tr>
<tr>
<td>Cottage cheese</td>
<td>1 oz</td>
</tr>
<tr>
<td>American cheese</td>
<td>1 oz</td>
</tr>
<tr>
<td>Swiss cheese</td>
<td>1 oz</td>
</tr>
<tr>
<td>Cheese pizza</td>
<td>2 slices</td>
</tr>
<tr>
<td>Cheese on ice cream or ice milk</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Salad, in oil</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Salmon, canned</td>
<td>3 oz</td>
</tr>
<tr>
<td>Red salmon</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Sardines, in oil</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Ice cream or ice milk</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Spinach, fresh cooked</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>1 oz</td>
</tr>
<tr>
<td>Broccoli, raw</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Kale</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Cheese pizza</td>
<td>2 slices</td>
</tr>
<tr>
<td>Cheese on ice cream or ice milk</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Swirl, in oil</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Calcium-fortified cereal</td>
<td>1 cup</td>
</tr>
<tr>
<td>Calcium-fortified orange juice</td>
<td>8 oz</td>
</tr>
</tbody>
</table>

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Tips for Those with Lactose Intolerance

- Choose calcium-rich foods with lower amounts of lactose
  - Yogurt with live active cultures
  - Hard cheeses (Cheddar, Colby, Swiss, Parmesan)
  - Lactose-free or lactose-reduced products
- Consume non-dairy products containing high levels of calcium
  - Fortified soy beverages, orange juice, etc

Calcium-Fortified Products

- In 1999, food makers introduced 119 calcium-fortified products. This was 3 times the number launched in 1998
  - Juice
  - Cereal
  - Bread products
  - Butter

4. Select Calcium Supplement

- Elemental calcium content

<table>
<thead>
<tr>
<th>SALT</th>
<th>% ELEMENTAL CALCIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>calcium carbonate</td>
<td>40%</td>
</tr>
<tr>
<td>calcium citrate</td>
<td>21%</td>
</tr>
<tr>
<td>calcium glutonate</td>
<td>6.5%</td>
</tr>
<tr>
<td>calcium gluconate</td>
<td>9%</td>
</tr>
<tr>
<td>calcium lactate</td>
<td>13%</td>
</tr>
<tr>
<td>dibasic calcium phosphate</td>
<td>23%</td>
</tr>
<tr>
<td>tribasic calcium phosphate</td>
<td>39%</td>
</tr>
</tbody>
</table>

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TUMS® Products

<table>
<thead>
<tr>
<th></th>
<th>Calcium Carbonate</th>
<th>Elemental Calcium</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUMS®</td>
<td>500 mg</td>
<td>200 mg</td>
</tr>
<tr>
<td>TUMS E-X Extra Strength®</td>
<td>750 mg</td>
<td>300 mg</td>
</tr>
<tr>
<td>TUMS Ultra®</td>
<td>1,000 mg</td>
<td>400 mg</td>
</tr>
</tbody>
</table>

Coral Calcium

- **Claims:**
  - Raises body pH to prevent disease
  - Superior absorption

- **Facts:**
  - No evidence calcium affects acid-base balance
  - No evidence of improved absorption
  - More expensive
  - The source of calcium less important than ensuring adequate intake

Absorption rates

- Average amount absorbed = 30%
- Best absorbed in an acidic environment
- Elderly & those on H₂ antagonists or proton pump inhibitors = calcium lactate and citrate may be preferable
- Chewable products may increase absorption
- Calcium absorption is decreased by dietary fiber, fiber laxatives, & antacids

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Product Selection

- Calcium carbonate is often recommended because of high % of elemental calcium and low cost
- Some suggest calcium citrate has greater bioavailability
- Lack of studies examining differences in therapeutic outcomes with various calcium preparations

Pharmacokinetic & Pharmacodynamic Comparison of Two Calcium Supplements in Postmenopausal Women

- **Design:** Single-dose bioavailability study. Blood drawn at baseline & hourly for 4 or 6 hr
- **Patient Population:** 25 postmenopausal women
- **Therapy:** Single dose of Citracal 250mg +D (ca citrate) & Os-cal 500mg +D (ca carbonate) & placebo
- **Results:** Calcium citrate provided a 46% greater peak-basal variation & 94% higher change in AUC for serum calcium

Lead content?
Lead Content of Calcium Supplements
JAMA 2000;284:1425-1429

Design: Analyzed the lead content in 21 formulations of OTC calcium carbonate including 7 natural (oyster shell) and 14 refined products

Results:
4 of the 7 natural products had measurable lead content
- Calcium 800 mg = 1 mcg/day lead
- Calcium 1,500 mg = 1 to 2 mcg/day lead
4 of 14 refined products had measurable lead content
- Calcium 800 mg = 1 to 2 mcg/day lead
- Calcium 1,500 mg = 2 to 3 mcg/day

Current absolute dietary lead limit = 6 mcg/day

What Does This Mean??

- Clinical significance unclear
- Some believe that lead coingested with calcium significantly reduces absorption
- Lead levels were not evaluated
- Look for products labeled as having been tested for lead content

Dose

Recommended dose of supplement

Recommended level

Daily dietary calcium intake

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Calcium is a threshold nutrient.

Adverse Drug Reactions

- GI
  - Constipation
  - Intestinal bloating
  - Gas
- Hypercalcemia
  - Unusual at doses ≤ 1.5 g/day

Drug Interactions

<table>
<thead>
<tr>
<th>DRUG</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazide diuretics</td>
<td>↑ risk of hypercalcemia</td>
</tr>
<tr>
<td>Atenolol</td>
<td>↑ atenolol peak plasma levels</td>
</tr>
<tr>
<td>Iron Salts</td>
<td>↑ GI absorption of iron</td>
</tr>
<tr>
<td>Levothyroxine</td>
<td>↑ GI absorption of levothyroxine</td>
</tr>
<tr>
<td>Quinolones</td>
<td>bioavailability</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>↑ tetracycline serum levels</td>
</tr>
</tbody>
</table>

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**Administration Issues**

- Take citrate between meals & carbonate with meals
- Take with 8 oz. of liquid
- Do not take more than approximately 500 – 600 mg/dose
- Do not take with high fiber meal

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**Vitamin D**

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**Functions**

- Helps maintain normal serum calcium levels
  - Increases calcium absorption in small intestine
Sources of Vitamin D

- Sun exposure
  - Require about 5-15 minutes of sun exposure 2-3 times/week without a sun screen

- Diet
  - Milk
  - Fatty fish, liver, eggs
  - Fortified cereals
  - Fortified orange juice

Vitamin D Content of Some Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>IU/serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon 3 ½ oz</td>
<td>380</td>
</tr>
<tr>
<td>Mackerel 3 ½ oz</td>
<td>345</td>
</tr>
<tr>
<td>Canned tuna 3 oz</td>
<td>250</td>
</tr>
<tr>
<td>Canned sardines 1 ½ oz</td>
<td>250</td>
</tr>
<tr>
<td>Milk 1 cup</td>
<td>98</td>
</tr>
<tr>
<td>Egg yolk</td>
<td>20</td>
</tr>
<tr>
<td>Fortified cereals</td>
<td>40</td>
</tr>
<tr>
<td>(servings vary by brand)</td>
<td></td>
</tr>
</tbody>
</table>

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Metabolic Activation of Vitamin D

23-Dihydrocholesterol (The principal provitamin which is synthesized in the skin.)

Skin

U.V. light

Vitamin D3 (Cholecalciferol)

Liver

Dietary sources

Kidney

25-OHD3 (Calcifediol)

The active form of vitamin D

Sources of Vitamin D

- Vitamin D2 (ergocalciferol)
  - Found in yeast & plants
- Vitamin D3 (cholecalciferol)
  - Found in fatty fish & cod liver oil
  - Made in the skin

Factors Affecting Vitamin D Levels

- Age
  - Skin less efficient at making vitamin D
  - Kidney less efficient at activation
  - Decreased GI absorption of vitamin D

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Factors Affecting Vitamin D Levels

- Sunlight exposure
  - Housebound and institutionalized people are at risk for inadequate exposure
  - Self-imposed avoidance
  - Sunscreens

Factors Affecting Vitamin D Levels

- Dietary intake
- Intestinal, liver or renal disease
- Alcoholism

Institute of Medicine 1997 Intake Recommendations

- Birth to 50 years = 200 IU/d
- 51-70 years = 400 IU/d
- >70 years = 600 IU/d
NOF Guidelines for Vitamin D

- Recommends 800 IU/day for persons at risk of vitamin D deficiency:
  - Elderly
  - Chronically ill
  - Housebound
  - Institutionalized

Use of Vitamin D in Osteoporosis

- Physiologic Use
- Pharmacologic Use

Physiologic Use in Osteoporosis

- Use in patients with deficiency
- Generally achieved through diet and/or multivitamin

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Hypovitaminosis D in Medical Inpatients

- **Patients:**
  - 290 adults admitted to a hospital for various reasons

- **Results:**
  - 57% had vit D deficiency
  - 42% of those under age 65 without a chronic condition that increased risk for vit D deficiency had a deficiency
  - A deficiency was present in 37% of those who reported consuming more than the recommended amount from diet or multivitamin

Prevalence of Vitamin D Inadequacy Among Postmenopausal North American Women Receiving Osteoporosis Therapy
J Clin Endocrinol Metabol 2005

- **Patient Population:** 1,536 community dwelling women receiving osteoporosis meds in 61 sites

- **Study Design:** Patient history & 25-hydroxyvitamin D level

- **Results:**
  - 52% had suboptimal 25(OH) D concen
  - Potential risk factors: high BMI, lack of exercise, lack of discussion with MD about vit D, vit D supplementation < 400 IU daily, education level < 12th grade

Most multivitamin preparations contain 400 IU of vitamin D.
Pharmacologic Use in Osteoporosis

- Use in patient with no obvious vitamin D deficiency
- Generally involves use of vitamin D metabolites
- Mixed results
- Wide spread use of vitamin D metabolites NOT recommended

Fracture Prevention with Vitamin D Supplementation: A Meta-analysis of Randomized Controlled Trials

*JAMA* 2005;293:2257-64

- **Methods:** Meta-analysis of 7 randomized controlled trials of vitamin D vs either calcium alone or placebo
- **Results:**
  - Vitamin D 400 IU daily had no effect on risk of hip fracture
  - 700 – 800 IU daily was associated with 26% relative risk reduction for hip fracture

Oral Vitamin D3 & Calcium for Secondary Prevention of Low-trauma Fractures in Elderly People

*Lancet* 2005;365:1621-8

- **Patient Population:** 5,292 community-dwellers > 70 yo with osteoporotic fractures within past 10 y
- **Therapy:** vitamin D 800 IU, calcium 1,000 mg, both agents or placebo
- **Results:**
  - 13% had new fracture
  - No significant differences in risk of fracture, number of falls or QOL among treatment groups
  - Poor adherence: 40 – 50% were taking 80% or more of the doses
Effect of Vitamin D on Falls: A Meta-analysis

Methods: meta-analysis of 5 double-blind, randomized, controlled trials of vitamin D in older adults (1,237 patients)

Results:
- Vitamin D supplementation reduces risk of falling by 22%.
- This effect appears to be independent of calcium supplementation, type of vitamin D, duration of therapy and gender.

Vitamin D Products
- Cholecalciferol (D₃)
  - Usual dosage: 400 – 1,000 IU
  - Available OTC
- Ergocalciferol (D₂)
  - Usual dosage: 25,000 – 100,000 U 3X/wk to once daily
- Calcifediol (25 (OH) D₃) Calderol®
  - Usual dosage: 20 – 50 mcg 3X/wk to once daily
  - Use: malabsorption, renal osteodystrophy
- Calcitriol (1, 25 (OH)₂ D₃) Rocaltrol®
  - Usual dosage: 0.25 – 1 mcg once daily to bid
  - Use: renal osteodystrophy, hypoparathyroidism, refractory rickets

Drug Interactions
- Cholestyramine and mineral oil: lower GI absorption
- Phenytoin and barbiturates: shortens half-life of vitamin D
**Vitamin D Toxicity**

- Tolerable upper level of 2,000 IU daily
- Major concerns are hypercalcemia and hypercalciuria
- Anorexia, nausea, weakness, vague aches and stiffness, constipation, diarrhea, disorientation, hallucinations, coma, kidney stones and renal failure
- Can cause increased bone loss

**CAUTION**
Evaluating all potential sources of vitamin D

**Serum Levels of Vitamin D**

- Measure 25 (OH) D3
  - Has long serum half-life (15-60 days)
  - Most accurately reflects body’s total vitamin D stores
- Not routinely done
- What is normal?
  - > 20 nmol/L
  - Some suggest > 30 ng/ml which is substantially higher than lab reference ranges
General Recommendations

- Ensure adequate sun exposure
- Improve dietary intake
- Use of a multivitamin

KEY POINTS

Adequate calcium & vitamin D supplementation are required adjunctive therapy with all medications for osteoporosis.

Other Nutrients and Bone Health
Other Nutrients and Bone Health

- Magnesium
- Vitamin K

Magnesium

- Essential for normal function of parathyroid glands, vitamin D metabolism and function of PTH and vitamin D metabolites
- 60% of the magnesium in the body is located in bone
- Appears to enhance bone quality

Magnesium Sources

- Milk
- Other dairy products
- Whole grains
- Nuts
- Legumes
- Green leafy vegetables
**Magnesium Sources**

- Most adult multivitamins = 100 mg
- Some cereals = 80 mg/cup

**Magnesium RDA = 350 mg/d**

- Deficiency rare in normal adults
- Deficiency generally due to
  - GI abnormalities
  - Renal dysfunction
  - Malnutrition
  - Alcoholism

**Magnesium & Osteoporosis**

- Magnesium deficiency is a risk factor
- Magnesium supplements indicated in known deficiency
- Use in non-magnesium deficiency being studied
Daily Oral Magnesium Supplementation Suppresses Bone Turnover in Young Adult Males
J Clin Endocrinol Metab 1998; 83: 2742-48

- **Patients:** 12 young healthy men
- Control group matched by age, height & weight
- **Dose:** Magnesium 350 mg/d for 30 days
- **Results:** Study group had significantly lower blood levels of markers of bone breakdown.

Is Magnesium Needed for Calcium Absorption?

- Some product advertisements say combination products containing calcium & magnesium are more effective
- No proof that this combination is any more effective in preventing bone loss or that calcium absorption is increased

Vitamin K

- Necessary for the synthesis of several factors in clotting cascade
- Several vitamin K dependent proteins have been identified in bone
- Vitamin K helps certain enzymes function properly to form optimal bone matrix
**Vitamin K and Bone Health?**

- **Nurses’ Health Study**
  - Dietary phyloquinone (vitamin K1) intakes < 109 mcg/d were associated with increased risk of hip fracture

- **Framingham Heart Study**
  - Greater incidence of hip fractures among elderly men & women in lowest reported quartile of phyloquinone intake compared to those in highest quartile of intake
  - There was NO association between dietary vitamin K and BMD

**Vitamin K Intake**

- 1989 RDA: 65-80 mcg
- Estimated average adult American diet provides 300-500 mcg/d
- Food sources
  - Spinach: 171 mcg/ ½ C frozen
  - Broccoli: 58 mcg/ C raw
  - Cabbage: 52 mcg/ ½ C raw
  - Cauliflower: 96 mcg/ ½ C raw

**Vitamin K and Bone Health?**

- The possible mechanisms whereby suboptimal vitamin K intake and status affect bone metabolism are poorly understood
- More research is needed to understand the mechanisms by which vitamin K may be a risk factor for hip fracture
Since many nutrients are important for bone health, it is important to eat a well-balanced diet containing a variety of foods.

KEY POINTS

Fall Prevention

Incidence of Falls

- About 24% of women and 16% of men age 50 or older fall each year
- About 48% of women and 35% of men age 85 or older fall each year
- One in 10 falls results in serious injury
Fall Prevention Checklist

- Common Sense

Fall Prevention Checklist

- Check vision

Fall Prevention Checklist

- Check for presence of postural hypotension and arrhythmia
Fall Prevention Checklist

- Review drug therapy

CNS Active Medications and Risk for Fractures in Older Women
Arch Intern Med 2003;163:949-957

- Patient Population: 8,127 elderly community-dwelling women followed for an avg of 4.8 years
- Therapy: benzodiazepines, antidepressants, anticonvulsants & narcotics
- Results:
  - Women taking narcotics were 40% more likely to have nonspine fractures
  - Those on antidepressants were 25% more likely to suffer nonspine fractures

Fall Prevention Checklist

- Check for appropriate footwear
Fall Prevention Checklist

- Check environment
  - Remove or firmly anchor rugs
  - Have good lighting throughout. Do not try to walk in the dark
  - Keep electrical and telephone cords away from walking areas
  - Equip bathroom, halls and stairways with handrails
  - Reduce slipperiness of tub or shower floor
  - Adjust seating and bed so easy to get into and out of

Fall Prevention Checklist

- Inform health care providers about any fall
  - Even those that do not result in injury

Summary of Preventive Measures

- Smoking cessation
- Physical activity
- Dietary improvement
  - Calcium
  - Vitamin D
- Fall prevention
KEY POINTS

Prevention strategies are:
- Appropriate for all ages
- To be continued for life
- Adjunctive therapy

“Optimization of bone health is a process that must occur throughout the lifespan in both males & females. Factors that influence bone health at all ages are essential to prevent osteoporosis and its devastating consequences.”

NIH Consensus Development Conference
Statement for Osteoporosis, March 2000

NOF Gallup Survey of Women With Osteoporosis

- Only 1/3 reported taking steps to prevent osteoporosis BEFORE their diagnosis
- The primary step taken was the use of calcium supplements
- 89% report NOW taking steps to slow their osteoporosis
Application Exercise #2
Creating an Osteoporosis Prevention Plan

Case Presentation
- Ms. Green is a 54-year old Caucasian female requesting BMD testing during a screening program
- Ms. Green lives a fairly active life enjoying a number of outdoor activities
- She is health conscious and is concerned about the possibility of developing osteoporosis

Summarize Ms. Green’s Identifiable Risk Factors
- Female
- Caucasian
- Body weight <127 lb
- Possibly: excessive thyroid hormone
**General Preventive Strategies**

- Physical activity
- Calcium
- Vitamin D

**Physical Activity History**

- Ms. Green walks her dog for about 30 minutes every day weather permitting
- She attends a yoga class 2 to 3 times weekly for 45 minutes most weeks
- Ms. Green plays golf 1 or 2 times a week about 4 months out of the year
- About 2 to 3 times each year, Ms. Green enjoys hiking while on vacation

**What is your assessment of Ms. Green’s physical activity in terms of her bone health?**

A. Meets recommendations, keep on keeping on
B. Consider adding resistance exercise 2-3 times weekly for 30 – 60 minutes
C. Consider adding resistance exercise 3-5 times weekly for 15-30 minutes
D. Reduce frequency of endurance activities to 2-3 times weekly

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Position Stand of Am College of Sports Med: Physical Activity & Bone Health

- Exercise prescription for adults
  - **Mode**: weight-bearing endurance activities, activities that involve jumping & resistance exercise that targets all major muscle groups
  - **Intensity**: moderate to high bone-loading force
  - **Frequency**: weight-bearing endurance activities = 3-5 times weekly; resistance exercise = 2-3 times weekly
  - **Duration**: 30-60 minutes

Best Answer

B. Consider adding resistance exercise 2-3 times weekly for 30-60 minutes

Considerations before hanging routine physical activity

- Patients with known CV disease or men over 40 and women over 50 with multiple CV risk factors should consult with a physician before beginning a moderate-intensity or greater exercise program
- Patients with known osteoporosis and/or fractures should seek professional assistance
**Calcium Intake Assessment for Ms. Green**

- Generally eats 1 cup of yogurt daily
- Centrum® Silver® 1 once daily

**What is Ms. Green’s current daily calcium intake?**

A. 400 mg  
B. 600 mg  
C. 800 mg  
D. 1,000 mg

**Best Answer**

B. 600 mg  
- 1 cup yogurt = 400 mg  
- Centrum® Silver® = 200 mg
Estimating Daily Calcium Intake From Calcium Rich Foods

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of Servings/Days</th>
<th>Calcium Content per Serving, mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (8 oz)</td>
<td>X</td>
<td>300</td>
</tr>
<tr>
<td>Yogurt (8 oz)</td>
<td>X</td>
<td>400</td>
</tr>
<tr>
<td>Cheese (1 oz)</td>
<td>X</td>
<td>200</td>
</tr>
<tr>
<td>Fortified Foods or Juices</td>
<td>X</td>
<td>80 – 1,000**</td>
</tr>
</tbody>
</table>

**Calcium content of fortified foods varies.

What is Ms. Green’s recommended daily intake of elemental calcium?

A. 800 mg  
B. 1,000 mg  
C. 1,200 mg  
D. 1,500 mg

Best Answer

C or D. 1,200 to 1,500 mg daily
- Recommendations vary
- Needs to add at least 600 mg of calcium to daily intake
  » Dietary additions
  » Calcium supplement
Which calcium supplement would you recommend?

A. Coral calcium
B. Calcium citrate
C. Calcium carbonate
D. Special bone formulation containing calcium, magnesium, vitamin K and boron

Best Answer

C. Calcium carbonate
- Calcium citrate not necessary based on patient’s age and medical conditions
- Highly unlikely patient has deficiency of calcium, magnesium, vitamin K or boron

Patient Education Points

- Take citrate between meals & carbonate with meals
- Take with 8 oz. of liquid
- Do not take more than approximately 500 – 600 mg/dose
- Do not take with high fiber meal
Vitamin D Intake Assessment for Ms. Green

- Centrum<sup>®</sup> Silver<sup>®</sup> 1 once daily
- Walks her dog for 30 minutes for most days

How much vitamin D should Ms. Green receive on a daily basis?

A. 200 IU  
B. 400 IU  
C. 600 IU  
D. 800 IU

Best Answer

B. 400 IU daily
  - RDA for individuals 51 – 70 yo is 400 IU
  - Ms. Green would not be considered a person at risk of vitamin D deficiency

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Any reproduction, photocopying, storage or transmission by magnetic or electronic means without the expressed written consent of NIPCO/NCPA and the payment of appropriate fees is strictly prohibited by law.
What is your assessment of Ms. Green’s vitamin D intake?

A. Currently meeting recommendations
B. Needs to increase her dietary intake
C. Should double the dose of her MVI
D. Should increase her sun exposure

Best Answer

A. Currently meeting recommendations
   – Check about degree of sun exposure during daily walks

Ways to achieve RDA for vitamin D

- Daily use of a multivitamin
- Perform physical activity requirements outside
- Fortified products such as orange juice
  – 1 cup is 25% of RDA
**Fall Prevention Plan**

- Essential component for individuals with osteoporosis
- Not necessary for Ms. Green

**Summarize Ms. Green’s Prevention Plan**

- Continue routine follow up with physician for management of hypothyroidism
- Add resistance exercise 2-3 times weekly for 30 – 60 minutes
- Increase calcium intake by at least 600 mg daily

**The Osteoporosis Pyramid**

- Pharmacotherapy
- Identify and Address Secondary Causes
- Lifestyle Changes
Osteoporosis Care Certificate Program
Prevention/Management of Osteoporosis

- Lifestyle Changes: General Preventive Strategies
- Calcium
- Vitamin D
- Other Nutrients and Bone Health
- Fall Prevention

√ Check Point
How Well Are You Able to:

- Explain the primary goals for the management of osteoporosis
- Describe the behavioral/lifestyle modifications for the prevention and management of osteoporosis and fractures including smoking cessation, physical activity, nutritional strategies and fall prevention
- Develop individualized prevention plans for patients
- Educate patients on the implementation of their prevention plans

Take Time to Review if Necessary

- Explain the primary goals for the management of osteoporosis [Lifestyle Changes: General Preventive Strategies]
- Describe the behavioral/lifestyle modifications for the prevention and management of osteoporosis and fractures including smoking cessation, physical activity, nutritional strategies and fall prevention [Lifestyle Changes: General Preventive Strategies]
- Develop individualized prevention plans for patients [Lifestyle Changes: General Preventive Strategies]
- Educate patients on the implementation of their prevention plans [Application Exercise #2]
Thank you for your participation.
Click below to proceed to the Post-Test.

Post-Test Button

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