Higher intake of vegetables, poultry and dairy products can contribute to improve serum levels of vitamin D

B. Peters (BR)
HIGHER INTAKE OF VEGETABLES, POULTRY AND DAIRY PRODUCTS CAN CONTRIBUTE TO IMPROVE SERUM LEVELS OF VITAMIN D

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Ethical dilemmas
Bioethical principles
Application of bioethical principles to “Nutrition at the end-of-life”
The decision-making process
• Subsample of a cross-sectional study of a representative sample of individuals living in São Paulo, Brazil;

• n=547 → adolescents, adults and elderly;

• Dietary intake was estimated by two 24-hour dietary recalls, adjusted by Multiple Source Method;

• Serum concentration of 25(OH)D was measured by HPLC (High-performance liquid chromatography)
The aim of the present study was to identify which food group could contribute to improve the serum levels of 25(OH)D
Correlation between serum levels of 25(OH)D and vegetables, poultry and dairy products intake.

$r=0.143; P=0.001$

$r=0.099; P=0.02$

$r=0.087; P=0.040$
## Adequacy of vitamin D

<table>
<thead>
<tr>
<th>Serum 25(OH)D (ng/mL)</th>
<th>Nutricional Descriptor</th>
<th>Serum 25(OH)D (nmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>Deficiency</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>20 - 30</td>
<td>Insufficiency</td>
<td>50 - 75</td>
</tr>
<tr>
<td>30 - 100</td>
<td>Sufficiency</td>
<td>75 - 250</td>
</tr>
<tr>
<td>&gt; 100</td>
<td>Excess</td>
<td>&gt; 250</td>
</tr>
<tr>
<td>&gt; 150</td>
<td>Risk for toxicity</td>
<td>&gt; 375</td>
</tr>
</tbody>
</table>

J Clin Endocrinol Metab. 2011;96(7):1911-30
Adequacy of serum levels of 25(OH)D.

- > 85.0% inadequacy

- 55.8%

- 30.5%

- 13.7%
Reported incidence of vitamin D deficiency defined as a 25-hydroxyvitamin D level below 20 ng/ml around the globe in pregnant women and general population.
Vitamin D for health: a global perspective.
What should we do to solve or minimize this health public problem?
Know and identify what are the risk factors of low 25(OH)D status

Risk factors for low serum 25(OH)D levels:

- Indoor environment
- Extensive clothing cover
- Excess sun avoidance (shade, sunscreen)
- Air pollution
- Exposure through glass
- Dark skin pigmentation
- Malabsorptive syndromes
- Obesity
- Hepatic/Renal failure
- Exclusive breastfeeding
- Pregnancy
- Aging
- No or low vitamin D supplements
- Low vitamin D diet without fortified food
- Lactose intolerance
- Socio-economic status
- Medication
  - Antiseizure drugs, Rifampin
  - Antiretroviral treatment, Glucocorticoids

High latitude location
- Winter season
- Outside peak the UVR times (10am - 3pm)
Encourage intake of foods rich in vitamin D

Vitamin D food sources

<table>
<thead>
<tr>
<th>Food</th>
<th>Portion</th>
<th>Vitamin D content per portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild salmon</td>
<td>100 g</td>
<td>~ 600-1,000 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Fish farming salmon</td>
<td>100 g</td>
<td>~ 100-250 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Canned sardine</td>
<td>100 g</td>
<td>~ 300 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Canned mackerel</td>
<td>100 g</td>
<td>~ 250 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Canned tuna</td>
<td>100 g</td>
<td>~ 230 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Cod liver oil</td>
<td>5 mL</td>
<td>~ 400-1,000 UI vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Egg yolk</td>
<td>1 unit</td>
<td>~ 20 IU vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>Fresh mushroom</td>
<td>100 g</td>
<td>~ 100 IU vitamin D&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td>Sun dried mushroom</td>
<td>100 g</td>
<td>~ 1,600 IU vitamin D&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Encourage intake of fortified foods with vitamin D

<table>
<thead>
<tr>
<th>Source</th>
<th>Vitamin D content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fortified foods</td>
<td></td>
</tr>
<tr>
<td>Fortified milk</td>
<td>100 IU/8 oz, usually vitamin D₃</td>
</tr>
<tr>
<td>Fortified orange juice</td>
<td>100 IU/8 oz vitamin D₃</td>
</tr>
<tr>
<td>Infant formulas</td>
<td>100 IU/8 oz vitamin D₃</td>
</tr>
<tr>
<td>Fortified yogurts</td>
<td>100 IU/8 oz, usually vitamin D₃</td>
</tr>
<tr>
<td>Fortified butter</td>
<td>561 IU/3.5 oz, usually vitamin D₃</td>
</tr>
<tr>
<td>Fortified margarine</td>
<td>429 IU/3.5 oz, usually vitamin D₃</td>
</tr>
<tr>
<td>Fortified cheeses</td>
<td>100 IU/3 oz, usually vitamin D₃</td>
</tr>
<tr>
<td>Fortified breakfast cereals</td>
<td>About 100 IU/serving, usually vitamin D₃</td>
</tr>
</tbody>
</table>
Encourage “healthy” solar exposure

- Cutaneous vitamin D3 production is influenced by:

  - Skin pigmentation
  - Sunscreen use
  - Time of day
  - Season
  - Latitude
  - Altitude
  - Air pollution
SUPPLEMENTATION

• WHO?

• HOW MUCH?
• WHO?

- Population risk:
  • rickets or osteomalacia
  • osteoporosis
  • history of falls and fractures in the elderly
  • obesity
  • pregnant and lactating women
  • patients with malabsorption syndromes (cystic fibrosis, inflammatory bowel disease, Chron’s disease, bariatric surgery)
  • renal or liver insufficiency
  • hyperparathyroidism
  • medications interfering in vitamin D metabolism (anticonvulsants, glucocorticoids, antifungal, antiretroviral, cholestyramine, orlistat)
  • granulomatous
  • Those to whom sunlight exposure is prohibited, due to skin cancer, transplants or systemic lupus erythematosus
- Serum 25(OH)D < 75nmol/L (<30ng/mL)
**HOW MUCH?**

Vitamin D daily maintenance doses recommended for the general population and the population at risk for the deficiency:

<table>
<thead>
<tr>
<th>Age groups</th>
<th>General population (IU)</th>
<th>Population at risk (IU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 12 months</td>
<td>400</td>
<td>400 – 1,000</td>
</tr>
<tr>
<td>1 – 8 years</td>
<td>400</td>
<td>600 – 1,000</td>
</tr>
<tr>
<td>9 – 18 years</td>
<td>600</td>
<td>600 – 1,000</td>
</tr>
<tr>
<td>19 – 70 years</td>
<td>600</td>
<td>1,500 – 2,000</td>
</tr>
<tr>
<td>&gt; 70 years</td>
<td>800</td>
<td>1,500 – 2,000</td>
</tr>
<tr>
<td>Pregnant women 14 – 18 years</td>
<td>600</td>
<td>600 – 1,000</td>
</tr>
<tr>
<td>Pregnant women &gt; 18 years</td>
<td>600</td>
<td>1,500 – 2,000</td>
</tr>
<tr>
<td>Lactating 14 – 18 years</td>
<td>600</td>
<td>600 – 1,000</td>
</tr>
<tr>
<td>Lactating &gt; 18 years</td>
<td>600</td>
<td>1,500 – 2,000</td>
</tr>
</tbody>
</table>

Adapted from the nutritional tables of the Institute of Medicine and the Endocrine Society.
When $25(OH)D < 50\text{nmol/L (20 ng/mL)} \rightarrow$ an attack dose is necessary to replenish the body stocks. The most used scheme currently is to administer 50,000 IU/week (or 7,000 IU/day) of vitamin D for 6 to 8 weeks.
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