**Nutrition Nuggets**

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**Outline**

- **Skeletal**
  - 15% of vitamin D endocrine function
  - Osteoporosis, osteopenia, osteomalacia

- **Non-skeletal**
  - 85% of vitamin D autocrine/paracrine function
  - Actions of vitamin D in cells
    - Immune functions
    - Cancer
    - Cardiac, Stroke
    - Multiple Sclerosis
  - Autoimmune
  - Type 1 DM
  - Depression
  - Ethnic differences

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**Risk Factors for Vitamin D Deficiency**

- Not in sun for past 50 years
  - 1950, 1960s: air conditioning and TV
  - 1970s, 1980s: children in school
  - 1990s: use of sunscreen

- Not found in foods, except fortified foods
  - Milk, cereal

- Dark skin
  - Barrier to absorption

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**Exposure to Sun**

- A single dose of UVB radiation
  - Light-skinned
  - 10-15 min
  - 20,000 IU vitamin D2 in 24 hours

- Dark skin can make D
  - But takes longer
  - Up to 10X as long

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**Sunshine**

1st conversion in skin

2nd conversion by liver

3rd conversion in kidney

1,25D3 Calcitriol

3rd conversion in cells

1,25D3 Calcitriol

Absorb Calcium

Strengthen Bones

Cell VDR

Imune/Resistance to Disease

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**Vitamin D: The Versatile Vitamin**
**Unexpected Fact:**

Vitamin D is not a vitamin

Vitamin D is a hormone
- Made by our body
- Made in one place
- Used in another place

**Sources of Vitamin D**
- Sun
- Fortified Foods
- Pool together
- Fortified Foods
- Supplements

**Vitamin D Iceberg**
- 15% calcium economy
- endocrine
- 85% cell cycle regulation, gene control
- autocrine

**Rickets + Osteomalacia**
- Rickets
  - Failure to mineralize; skull, rib, leg
  - Cod liver oil
- Osteomalacia
  - Hard shell, soft inside
  - Lack of D
  - Fast weight loss

**Osteoporosis + Osteopenia**

**Vitamin D Action – Skeletal**
- Structure
  - Assist with calcium absorption
- Skeletal – Calcium Balance
  - When blood levels Vit D - 32 ng/mL (80 nmol/L)
Vitamin D Action – Skeletal
Vitamin D Threshold

Minimal/optimal, serum Vit D level is about 32 ng/mL for best calcium absorption. Calcium absorption rises as 25(OH)D rises.

Heaney RP. Vitamin D endocrine physiology. J Bone Miner Res. 2007 Dec;22 Suppl 2:S2-7

Vitamin D Deficiency: Non-Skeletal
- Started accumulating for 7-10 years ago (after the last RDAs were printed)
- Epidemiological relationships
- Then discover “if” and “how”
- Expand research to larger groups
- Then determine levels needed
http://www.medicalnewstoday.com/articles/161618.php

Vitamin D Actions
Tight vs Disjunction
- Vit D activates cell adhesion
  - E-cadherins, catenins, laminin
- Low vitamin D – disjunction
- DNA errors or epigenetic events
- Rapidly dividing, aggressive, compete, penetrate membrane

Cadherins
(Calcium dependent adhesion molecules)
Vitamin D Actions

- Apoptosis
  - Programmed sequence of events leading to cell death
  - No release of harmful substances

Vitamin D Deficiency: Reduced Immunity

- The innate immune system
  - Rapid response to bacteria, viruses, parasites, etc.
  - Antimicrobial peptides defensins and cathelicidins
  - 1,25-dihydroxyvitamin D₃ and three of its analogs
    - Cathelicidin antimicrobial peptide (CAMP) gene.
  - Antimicrobial peptide and anti-inflammatory
**Vitamin D Actions**

- Potent Immune Modulator
  - Enhance innate immunity
  - Inhibit development of autoimmunity

**Vitamin D Deficiency: Reduced Immunity**

- H1N1 influenza virus outbreak
  - Should be evaluated

- Canada
  - Researchers in PHAC with McMaster University
  - Correlation between severe disease and low vitamin D levels
  - *This line of research in seasonal influenza will be adapted to H1N1*

PHAC sent e-mail to NutraIngredients-USA.com

**Vitamin D Contradictions, in Terms of Immune Responses**

- Does vitamin D help to promote immune reactions, i.e. helps attack foreign antigen?

- Or **Evidence shows that it does both!**

- Does vitamin D suppress immune attack, and prevent auto-immune disease?

**Vitamin D Deficiency – Autoimmune**

- Autoimmune diseases such as
  - Allergies
  - Multiple Sclerosis
  - Crohn’s
  - Fibromyalgia
  - Lupus
  - Rheumatoid + Osteoarthritis

**Vitamin D Actions**

- Anti-inflammatory action
  - Sometimes as COX-2 inhibitor
  - Decreases C-Reactive Protein
  - Infections

- Regulate 200 different genes
  - Responsible biologic processes

**Vitamin D Deficiency: Diabetes & Glucose Control**

- 2000 IU/d – Finland
  - 1st year of life
  - Reduce risk type 1 diabetes over 30 yr by 80%

- Boston-based Joslin DM Center
  - 75% of young type 1 DM, insufficient Vit D level
Vitamin D Deficiency: Cancers – 21 Different

Garland C. Vit D and Cancer. Present to IOM, Aug 4, 2009

Lab Measurement

- **Deficiency**
  - <8ng/mL
  - (<20 nmol/L)

- **Insufficiency**
  - 8.4-11.6 ng/mL
  - (21-29 nmol/L)

- **Old Lab Values**
  - 12-28 ng/mL
  - (30-70 nmol/L)

- **Current Normal**
  - 25-70 ng/mL
  - (63-175 nmol/L) Need at least 4000 IU per day to support this level

- **Future**
  - 40-60 ng/mL (req to the IOM)
  - (50-100 proposed by Garland)
  - (100-240 nmol/L)

- **Toxic**
  - >200 ng/mL
  - (>500 nmol/L)

Vitamin D Summary

<table>
<thead>
<tr>
<th>Level in ng/mL*</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8</td>
<td>Rickets and osteomalacia</td>
</tr>
<tr>
<td>12 – 28</td>
<td>Osteoporosis and osteopenia</td>
</tr>
<tr>
<td>&gt; 32</td>
<td>Necessary for good calcium-PTH homeostasis</td>
</tr>
<tr>
<td>40 - 60</td>
<td>Recommended by vit D researchers to Institute of Medicine to become the normal laboratory standard of measure</td>
</tr>
<tr>
<td>50 -100</td>
<td>Recommended by Dr. Cedric Garland to be the best normal levels</td>
</tr>
<tr>
<td>&gt;200</td>
<td>Beginning of toxic range</td>
</tr>
</tbody>
</table>

Vitamin D Supplements

- **RDA+**
  - RDA = 400 IU
  - Upper Level = 2,000 IU
  - Toxic =

- **Future**
  - 1,000 - 2,000 IU
  - 10,000 IU
  - >30,000 IU/day

- **Individual Vitamin D**
  - Softgel or drops
  - Vitamin D3
  - 1000 IU or 2000 IU (50 mcg or 100 mcg)

- **Over the counter**
  - Walgreens
  - Target
  - CVS

- **Internet**
  - Be sure it is softgel or drops
  - Amazon.com
  - Vitacost.com
  - Carlson labs
In Brief - Serum Calcitriol

- ↑ Vit D levels are ↓ (inversely) related to most chronic diseases
- Vitamin D works in multiple systems
- RDA Needs to be higher than current 400 IU

Summary

- Most of us need a supplement
  - 1000 → 2000 IU per day
  - Possibly 6000 IU per day for 3 months

- Healthy blood levels
  - 40 to 60 (50 to 100) ng/mL or higher

Missing vs Addition

- “Dietary omission rather than the addition of chemical carcinogens leads to tumor formation.”

- Nutrients of concern
  - Vitamin D
    - DHA
    - Vitamin B12
    - Calcium
  - Choline
  - Soluble fiber
  - Iron

The Sun and “The Son”

The Ceaseless Son

- Always there and available
- Source of all energy we have
- Tsents and purifies by killing germs
- Easy to receive
- Touches you
- Selected spiritual beings, enlighten the spirit
- Exhale the White Being
- Change the spirit: lengthen the soul, lengthen the spirit

Heal, Build and Protect the Soul

- A person who includes vitamin D in their living, has cells that are quiescent, hold tightly together and protect from intrusion

References

Information Gathering Workshop for Dietary Reference Intakes for Vitamin D and Calcium
Researchers present to Food and Nutrition Board of the Institute of Medicine Petitioning them to change the vitamin D recommendations from RDA 400 IU and Upper 2000 IU to RDA of 2000 IU and Upper 10,000 IU.

Presentations, either video or power point and audio, of several noted Vitamin D researchers including Garland, Gorham, Giovannucci, Heaney. University of California TV - Vitamin D Deficiency: Treatment and Diagnosis  
http://www.uctv.tv/vitaminD/ 

Grassroots - D Action  
http://www.grassrootshealth.net/ 


Snopes is for looking up myths and urban legends to see if accurate,  
http://www.snopes.com/ 

Dr. Holick  
http://www.uvadvantage.org/portals/ci/prn/