Workshop on Vitamin D

A Global Assessment of Vitamin D Status in Healthy Populations

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visit www.100yearsofvitamins.com

100 years of vitamins for a brighter world

In 1912, the word “vitamin” was coined by Casimir Funk to describe biochemical substances essential for human and animal health. The past century has witnessed remarkable discoveries that have advanced our understanding of vitamins and their vital role in health and wellness. DSM, the global leader in vitamins, is proud to have been part of this vitamin journey and is committed to making further scientific advances for generations to come.
Vitamin D renaissance: the inadequate status impacts a number of body functions

**Classical role of vitamin D: bone health**
- Improves bone mineral density through calcium absorption and deposition
- Necessary to prevent rickets & osteomalacia

**Emerging health benefits of vitamin D**
- **Muscle**
  - Reduces risk of falling by improving muscle strength
- **Immunity**
  - Strengthens the immune system
  - Reduces risk of multiple sclerosis and diabetes type I and II
- **Cardiovascular**
  - Lowers blood pressure
- **Cancer**
  - Inhibits cell proliferation
Scientific evidence supports vitamin D benefits in different segments

- ~3500 publications in 2011
- More than 250 human studies ongoing
- Indications well beyond bone health

Vitamin D

- Bone (14'605 publications)
  - Colon cancer (459 publications)
  - Muscle (1'583 publications)
  - Multiple sclerosis (260 publications)
  - Diabetes type I & II (1'287 publications)
- Immunity (1'001 publications)
- Blood pressure & CVD (2'721 publications)
- Tuberculosis (493 publications)
- Brain & cognition (1123 publications)

PubMed Hits

- Vitamin D in Title / Abstract

Year


PubMed Hits

0 500 1000 1500 2000 2500 3000 3500

DSM

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Vitamin D comes from different sources

- **Sun**
  - 7-Dehydrocholesterol
  - Vitamin D
  - Liver
  - 25(OH)D: Major circulating form
  - Kidney
  - 1,25(OH)₂D: Active form

- **Supplements**

25(OH)D serum level is the relevant indicator of Vitamin D status (IOM 1997)

<table>
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<th>nmol/L</th>
<th>&lt; 25</th>
<th>25 - 50</th>
<th>50 - 75</th>
<th>&gt; 75</th>
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<td>deficient</td>
<td>insufficient</td>
<td>(in)adequate</td>
<td>desirable</td>
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<table>
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<tr>
<th>ng/ml</th>
<th>&lt; 10</th>
<th>10 - 20</th>
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<td>100 YEARS OF VITAMINS</td>
<td>DSM</td>
<td>BRIGHT SCIENCE. BRIGHTER LIVING.</td>
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Why a global map on vitamin D?

- Provide a global overview on the vitamin D status in the general population
- Understand the situation by regions, countries and by sub-groups.
- Generate awareness for the role of vitamin D for health
- Advocate for actions to improve vitamin D levels in populations/groups at risk for low status
Approach taken

- **Systematic review according to PRISMA**
  (Preferred Reporting Items for Systematic reviews and Meta-Analyses)
  - Collaboration with the Mannheim Institute of Public Health, Germany

- **Visualizing the outcome (Global Map)**
  - Co-created with the International Osteoporosis Foundation (IOF)
Approach taken for systematic review

- **PubMed**
  - n = 1635
- **Embase**
  - n = 1380

Combined
- n = 2566

Records in abstract
- n = 601

Records in full-text
- n = 273

Unique studies
- n = 196

Search for relevant studies in relevant data bases

Exclusion of not relevant publications
- No outcome measures
- Vitamin D
- Patient populations
- Duplicates
- Reviews
- Others

Taken into account
Building a map on global vitamin D status

- The challenge:
  Quality and quantity of data differs between the countries

- Assigning a color code to a specific country was based on hierarchical selection criteria:
  1. Representative of the entire country
  2. Representative of a region/city of the country
  3. Based on a weighted mean of multiple studies
  4. Based on a single study
Studies fulfilling the following criteria were selected

- Randomly selected persons from the general population in countries worldwide
- Mean or median 25(OH)D serum levels reported
- Population-based cohorts
- Only English publications
- Published between Jan 1\textsuperscript{st} 1990 to Feb 28\textsuperscript{th} 2011
Global Vitamin D status in children & adolescents

http://www.iofbonehealth.org/facts-and-statistics/vitamin-d-studies-map

Ref: Wahl DA et al, Archives of Osteoporosis 2012
Global Vitamin D status in adults
http://www.iofbonehealth.org/facts-and-statistics/vitamin-d-studies-map

Ref: Wahl DA et al, Archives of Osteoporosis 2012
Main findings (1)

- Data coming mostly from Europe (48%), followed by North America (27%) and Asia Pacific region (16.5%)
- Insufficiencies affect both developing world and industrialized countries
- Women have lower status compared to men
Main findings (2)

In children and adolescents, predominant colour is orange (25-49 nmol/L), which means that levels are in the insufficient range.

Gaps in data:
Central America, much of South America, most of Africa, much of Europe, in Australia
Main findings (3)

In **adults**, predominant colour code is **orange** (25-49 nmol/L) and **yellow** (50-74 nmol/L)

Gaps in data:
*Central America, South America (with the exception of Brazil), much of Africa*
Limitations of the Map

- Variability in the measurement of vitamin D
- Seasonality of vitamin D levels
- Adequate information not always available, e.g:
  - small study in a limited region of a country and a too narrow age range
  - small regions within large countries with diverse latitudes
- Information on clothing habits and skin pigmentation not always available
Broad variation of studies: example Vitamin D levels in Switzerland

Vitamin D levels are critical in institutionalized people compared to free-living elderly
Vitamin D status in hospitalized elderly is critical (Theiler et al, 1999)
Vitamin D levels throughout Europe

High variations within one country and between countries
Seasonal variations in representative samples in Switzerland & Germany

Switzerland

Germany

Burnand et al, 1992

Hintzpeter et al, 2008
Vitamin D Status of migrants and non-migrants children and adolescent in Germany

Infants achieve a higher vitamin D status due to recommended supplementation during the first year of life

Hintzpeter, 2009
Inadequate vitamin D status is a global issue

In summary

88.1% below 75 nmol/l = est. 6.2 bio
37.3% below 50 nmol/l = est. 2.6 bio
6.7% below 25 nmol/l = est. 500 mio

Inadequate vitamin D status is a global issue
How to achieve adequate Vitamin D level

Randomized Clinical Trials with vitamin D less than 10‘000 IU per day and duration of at least 4 weeks

Conclusion

- Optimal 25(OH)D range between 75 - 110nmol/L
- These levels can be obtained with oral doses in the range of 800 IU – 2000 IU
- Benefit is clearly dose dependent
Ways of Increasing Vitamin D Intake

1. Increase exposure to limited daily sunlight

2. Improving nutrition: consume foods that are high in vitamin D (fatty fish, eggs, fortified products)

3. Supplementation should be considered for people who are vitamin D insufficient or at risk
Conclusion

- Vitamin D deficiency is a global issue affecting developing and developed countries.
- Specific groups like pregnant women, infants, elderly can be even more at risk.
- Especially, in the Middle East, Asia and Southern Europe vitamin D deficiency is widespread.
- Vitamin D deficiency and inadequacy has detrimental health effect.
- Ensuring desirable Vitamin D levels is a cost effective approach for a healthy and productive life.

The scientific evidence calls for action by a joint approach of the key stakeholders.