INTERACTIVE MAPS ON VITAMIN D LEVEL WORLDWIDE

International Osteoporosis Foundation (IOF) and DSM Nutritional Products (DSM) have jointly developed an interactive worldwide map on vitamin D status.

Two global maps illustrating vitamin D status - one for children and one for adults - have been developed. The data is derived from a systematic review of the worldwide literature published between 1990 and 2011, according to standardized criteria and guidelines. 200 single studies from 46 different countries all over the world met the inclusion criteria and were evaluated to develop the global maps.

The systematic review has been conducted in collaboration with the Mannheim Institute for Public Health, Germany.

OBJECTIVES

- Provide an overview and illustrate the vitamin D status in the general population on a worldwide map.
- Understand the extent by regions and countries.
- Examine the existing heterogeneities in vitamin D status.
- Identify research gaps.
- Encourage awareness of differences in vitamin D levels across Europe and worldwide.

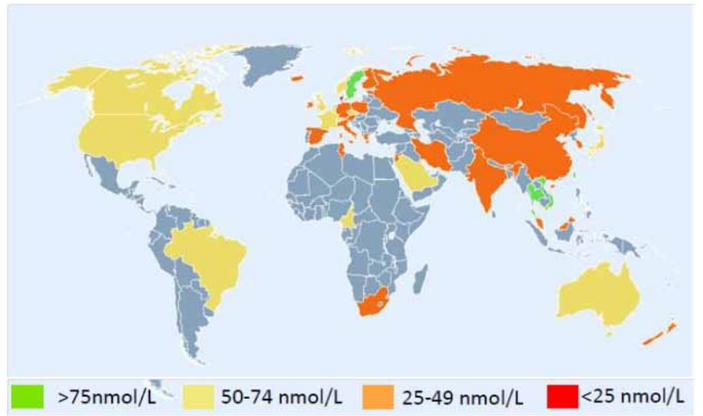
KEY FINDINGS

- Overall, insufficient vitamin D levels were detected in more than one third of the study population[1].
- Vitamin D insufficiency affects both the developing world and industrialized world.
- The main source of vitamin D is sunlight, but even in sunny countries, vitamin D levels are generally low and below recommended levels (taking India as example: a sunny country; yet, with low vitamin D status).
- Rates of vitamin D insufficiency are higher amongst women than men.
- It is estimated that 50 -70 % of the European adult population have insufficient levels of vitamin D.
- In US adults, vitamin D insufficiency estimates range from 20% (non-Hispanic whites) – 70 % (non-Hispanic blacks).
- Older people are especially at risk for vitamin D insufficiency, including older women who are a risk group for osteoporosis, and those living indoors in institutionalised care.

CONCLUSIONS

- Low vitamin D status is clearly a public health issue worldwide.
- Low vitamin D status can affect all age groups.
- Low vitamin D status has a significant impact on human health and in particular on osteoporosis and subsequent risks of falling and fractures.
- Low vitamin D status, and subsequent falling and fractures, has a significant impact on health care costs.
- A further increase in life expectancy is anticipated worldwide and low vitamin D status will become even more of an issue in the near future.
- A standardized assay is recommended to measure 25(OH)D serum levels in order to enhance
- comparability.
- The scientific evidence on the low vitamin D status worldwide calls for action by a joint approach of the key stakeholders.
- It is difficult to compensate for a lack of sunlight exposure with dietary improvements alone.

Vitamin D status in adults (> 18 years) around the world



KEY FINDINGS FOR ADULTS > 18 YEARS

- Among adults, most regions offer some data. Serum 25(OH)D levels are higher in Western than in Eastern regions; yellow is predominant in the Western part and orange more in Eastern parts.
- Areas where information was not identified include Central America, South America (with the
- exception of Brazil), and much of Africa.
- For North America, several representative and population-based studies exist for the US population. Global vitamin D levels seem higher in USA and Canada compared to other continents, with the predominant colour of yellow indicating a vitamin D status between 50 and 74 nmol/l.
- Vitamin D status varies in Europe with general lower, insufficient levels in the South especially in Italy, Spain and Greece. Also Germany, Austria and Finland show a low 25(OH)D level below 50 nmol/l, indicating vitamin D insufficiency. The high serum level in Sweden is probably due to a high intake of fatty fish and cod liver oil.
- In the Middle-East data for only two countries is available. Vitamin D insufficiency is very common in Iran despite sunshine all year around, whereas Saudi Arabia has 25(OH)D levels between 50 and 74 nmol/L.
- In most of Asia Pacific vitamin insufficiency with a 25(OH)D level between 25 – 49 nmol/l is highly prevalent in adults whereas Thailand, Fiji Islands, Taiwan and Vietnam report a desirable level of 75 nmol/l.
- Regions where data is available: the predominant colour is orange, such as for Canada and Asia, indicating an insufficient 25(OH)D level between 25 – 49 nmol/l.
- These values are below those recommended by the Institute of Medicine (50 nmol/L)
- This information needs attention in view of the importance of vitamin D in bone and muscle growth and development.

DEVELOPMENT OF THE WORLDWIDE MAPS

- Two different age categories were selected:
  Children and adolescents (1 – 18 years)
  Adults (> 18 years)
- Mean serum 25(OH)D levels were extracted and reported as gender-specific means weighted by sample size where possible.
- When available, winter values were used to calculate the mean 25(OH) D levels.
- Four colour codes according to mean serum levels of 25(OH)D were applied.
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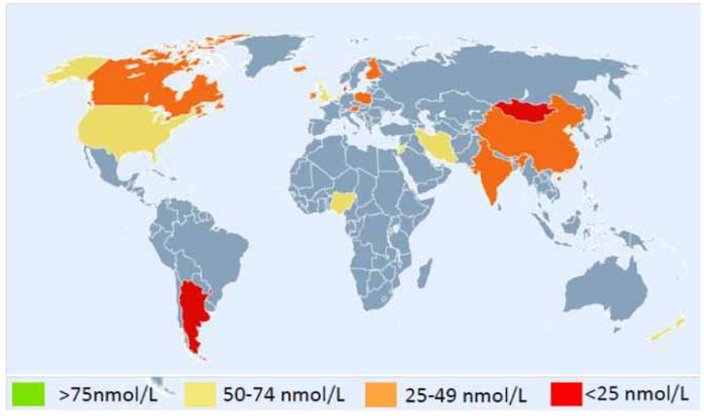
Vitamin D status in children and adolescents (1 – 18 years) worldwide



KEY FINDINGS FOR CHILDREN AND ADOLESCENTS:

- Widespread gaps in children and adolescents where information on the 25(OH)D levels is lacking.
- Most striking for lacking of any data is Central America, Northern and Central regions of South America, most of Africa, much of Europe, and in Australia.

GREEN >75nmol/L
YELLOW 50-74nmol/L
ORANGE 25-49nmol/L
RED <25nmol/L

RATIONALE FOR THE COLOURING OF COUNTRIES

For both age categories, the rationale for assigning a colour to a specific country was based on the following hierarchical selection criteria:

1. Available data from several studies for the entire country, based on a weighted average of these studies.

2. Available data from several studies for a region/city of the country, based on a weighted average of these studies.

3. Available data based on a single study for the entire country.

4. Available data based on a single study for a region/city within the country.

LIMITATIONS OF THE MAPS

Despite using data from a systematic literature review the maps have limitations. The study base is quite heterogeneous and adequate information is not available for some countries. As an extreme example, one single study confined to a limited region was used to colour countries such as Argentina or Mongolia for children; thus they did not fairly represent the whole country. Furthermore there was inconsistency for thresholds for age groups. In view of the diversity of quality and quantity of data the maps have to be interpreted with caution. One further limitation is the variability in vitamin D assays described and the inter-study comparison of the 25(OH)D levels.

NEW RECOMMENDATIONS FOR HIGHER VITAMIN D INTAKE

As a concern to the widespread vitamin D deficiency and the beneficial effect of vitamin D on bone health government documents, position statements and clinical practical guidelines have recently been published with higher recommendations for daily vitamin D intake.

- As early as 2008, the American Academy of Pediatrics (AAP) issued an update of their guidelines for vitamin D intake and rickets prevention which doubles the recommended dose of vitamin D for children to 400 IU per day beginning in the first few days of life and continuing throughout adolescence.
- In 2010, the US Institute of Medicine (IOM) published a new assessment of Dietary Reference Intakes (DRI)2 for vitamin D across all age groups, taking account of new scientific research findings since their previous review in 1997. Based on this evidence, the IOM has tripled the recommended daily intakes of vitamin D to 15 μg (600 IU) per day for people aged 1-70 years, and increased to 20 μg (800 IU) per day for those older than 70 years.5 The IOM also concluded that 100 μg (4000 IU) vitamin D per day constituted a safe upper intake for people aged 9 years and older; in children below the age of 9 years, the safe upper intake level is lower to account for the lower body weight of this age group.
- In January 2012 the German, Austrian and Swiss Nutrition Societies (D-A-CH) took action and increased vitamin D dietary recommendations to 20□g (800 IU) for all age groups except infants (up to 1 year) during periods when endogenous synthesis is low. They increased the recommended intake fourfold to 20 μg (800 IU) / day for the general population 1-65 years of age and doubled it to 20 μg (800 IU) /day for elderly over 65 years.
- In July 2012 the European Food Safety Authority (EFSA) released the updated Tolerable Upper Intake Levels (ULs) of vitamin D: the UL for adults including pregnant and lactating women was set at 100 μg/day (4.000 IU/d); the UL was adapted to 100 μg/day for ages 11-17 years.
- Taking into account their smaller body size, a UL of 50 μg/day (2000 IU/day) is proposed for children aged 1-10 years.
- In 2011 the European Food Safety Authorities (EFSA) issued a positive opinion on a health claim Article 14 on the use of vitamin D to reduce the risk of falls and fractures for the elderly *http://www.efsa.europa.eu/en/efsajournal/pub/2382.htm*

Furthermore, key opinion leaders are increasingly recommending higher daily intakes for vitamin D, between 800-1000 IU or even 2000 IU, for people at risk. Recent recommendations by the International Osteoporosis Foundation (IOF), the US Endocrine Society and the American Geriatric Society/British Geriatric Society Clinical Practice Guideline agree that vitamin D is beneficial for bone health and the risk of falling and identified vitamin D as an effective intervention to prevent falling in elderly.

The IOF recommends that those at risk of osteoporosis and generally everyone aged 60 years and older take vitamin D supplements at a dose of 800 – 1000 IU (20-25 □g) per day. Even with a balanced diet, this level is difficult to achieve, which is why there is a clear case for supplementation and the fortification of foods. To achieve 800 IU of vitamin D by diet alone would mean consuming 2 portions of fatty fish or 40 eggs every day.

References

[1] Blood levels below 50 nmol/l considered as insufficient.

[2] The IOM now uses nutrient reference values entitled **Dietary Reference Intakes (DRI)**. They are expressed in micrograms per day, which can be converted to International Units (IU). 5 micrograms vitamin D is equivalent to 200 IU.