Vitamin D

...a perfect storm is building
1912-2012: 100 Years of Vitamins

1912: Term “vitamin” coined by Casimir Funk

1910: Umetaro Suzuki discovers vitamin B₁

1923-2000: Mandatory fortification of salt, flour, cereal products, sugar, wheat, maize and dairy in many countries successfully controls deficiencies of vitamins A, D, B vitamins, iodine and iron

1946: 1st large-scale industrial synthesis of vitamin A by Roche

1934-87: Industrial production of vitamins begins, starting with ascorbic acid (vitamin C) by Roche, Switzerland

1906-33: 13 vitamins identified and characterized

2000- onwards: Intake surveys show insufficient vitamin status in industrialized countries

2003: DSM acquires Roche Vitamins & Fine Chemicals

2010-11: DSM acquires Martek, Microbia & Vitatene

1970s-90s: National supplementation programs provide vitamin A to underfive children and successfully reduce severe vitamin A deficiency in developing countries

2000: Human genome analyzed and published
Micronutrient deficiencies affect developing AND developed nations

1.1 million underfive lives lost due to vitamin A & zinc deficiencies

600,000 stillbirths due to iron deficiency

18 million babies born mentally impaired due to maternal iodine deficiency

30 billion US$ per year - estimated direct cost of child & maternal undernutrition in developing countries

40-75 per cent of world population estimated to be vitamin D deficient

200 million women estimated to be affected by osteoporosis, linked to vitamin D deficiency, worldwide

187 billion € - potential health care savings if >300 million people in 17 European countries have access to 2000-3000 IU vitamin D daily
Both in developing and in developed countries:

**Vitamin Deficiency**

25(OH)D serum level is best indicator to determine vitamin D status (IOM 1997)

- **normal levels** >75 nmol/L = >30 ng/ml
- **inadequacy** >50 <75 nmol/L = >20 <30 ng/ml
- **insufficiency** < 50 nmol/L = < 20 ng/ml
- **deficiency** < 25 nmol/L = < 10 ng/ml
DSM is joining forces with IOF
Making vitamin D deficiency visible
The deficiency awareness is growing
Stakeholders are changing gears

EU doctors deciding on elderly vitamin D levels

Department of Health
Public health, adult social care, and the NHS
Vitamin D – advice on supplements for at risk groups
2 February, 2012

Bupa urges everyone to take vitamin D to reduce cancer risk

American Academy of Pediatrics
AAP doubles vitamin D recommendation for children
New recommendations for pregnant and lactating women

German Society for Nutrition increases daily intake reference values for vitamin D, January 10 2012

The German Society for Nutrition (DGE) has published – jointly with the Austrian Society for Nutrition (ÖGE) and the Swiss Society for Nutrition Research (SGE) – new recommendations for the daily intake of vitamin D:

- Infants are recommended 400 IU (10 mcg)
- All other age groups, including pregnant and lactating women, are recommended 800 IU (20 mcg)

These reference values are significantly higher than both the former ones recommended by the DGE and the current ones recommended by the US Institute of Medicine (IOM).
Nestle AU starts with own workers to create awareness
The public health business case

363 mio people in 17 European countries

Estimated 105 bio € savings in direct and 82 bio € savings in indirect economic burden associated with Vit D impacted diseases

- Osteoporosis
- Cancers
- Metabolic syndrome
- CVD
- MS
- Diabetes Type II
- Hypertension
- Stroke
- Congestive heart failure

At a daily intake of 2’000-3’000IU Vit D

Health care savings of 187 bio €/yr

Supplementation cost of 0.075 € / day pp

Estimated yearly costs at 2’000-3’000 IU/day: 10 bio €

*Estimations based on 2009 review by Grant et al. in Progress in Biophysics and Molecular Biology*
Vitamin D - Call for political action!  
European Parliament, March 23d 2010

> 100 participants discussed the urgent need for prevention, education and consumer choice on Vitamin D

Proper Vitamin D application is adopted as part of the “Action for Prevention” health priorities
A ‘silver tsunami’ is coming to Asia

Figure 4: Getting older
% of population aged over 65

Source: UN Department of Economic and Social Affairs, Population Division (forecasts use median population projection). Taiwan data from Taiwan Statistical Data Book 2009, Directorate General of Budget, Accounting and Statistics.

Projected percentage of population aged 60 and older. Source: UN
DSM awarded with a disease risk reduction health claim

Vitamin D may reduce the risk of falls and bone fractures

Scientific Opinion on the substantiation of a health claim related to vitamin D and risk of falling pursuant to Article 14 of Regulation (EC) No 1924/2006\(^1\)

On the basis of the data presented, the Panel concludes that a cause and effect relationship has been established between the intake of vitamin D and a reduction in the risk of falling.

The Panel considers that the following wording reflects the scientific evidence: “Vitamin D may reduce the risk of falling. Falling is a risk factor for bone fractures”.

- Article 14 Disease Risk Reduction health claim
- The claimed effect requires consumption of 800 IU (20 µg) of vitamin D daily
- The target population is men and women 60 years of age and older

DO-HEALTH: Europe starts largest healthy aging study
EU partners with Nestle, DSM and Roche Diagnostics

EU research project will provide ‘definitive’ evidence on healthy aging: Bischoff-Ferrari

By Nathan Gray, 06-Feb-2012
Related topics: Research

A new international study hopes to provide definitive evidence that vitamin D, omega-3, and exercise can reduce the burden of chronic diseases in the elderly.

The European Commission backed DO-HEALTH study (VitaminD3-Omega3-Home Exercise-Healthy Ageing and Longevity Trial) will be Europe’s largest healthy ageing study, and is expected to provide solid evidence for the efficacy and safety of three simple preventative interventions: vitamin D, omega-3 fatty acids and a simple home exercise programme, says the project’s principal investigator Professor Heike Bischoff-Ferrari.

Vitamin D expert Bischoff-Ferrari, who is director of the Centre on Aging and Mobility at Zurich University, told NutraIngredients that the new 12.8 million Euro research project “is an attempt to create evidence for three simple strategies to improve health at older age.”

She explained that there is a wealth of information in the scientific literature that suggests vitamin D, omega-3 fatty acids, and exercise can all help to improve health endpoints. However, the evidence for

- DO-HEALTH will study impact of Vitamin D3, Omega3 and exercise on aging
- 12.8 mio Euro
- > 2000 participants in 5 countries and 8 centers, during 3 years
- Focus on prevention!
IOC is recognizing importance of Vitamin D for athletic performance

Breaking News on Supplements & Nutrition - Europe

IOC: Food supplements can enhance athletic performance

By Shane Starling, 05-Jan-2011

Food supplements can boost athletic performance, according to new advice from the International Olympic Committee (IOC) that marks an about face from earlier positions.

Vitamin D was singled out as being necessary where there was a lack of sunshine.

"Athletes should be particularly aware of their needs for calcium, iron and Vitamin D, but the use of large amounts of some micronutrients may be harmful."

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Popular press creates consumer awareness

What Do You Lack? Probably Vitamin D
BY JAMIE B. BRODY
Published July 26, 2010

Vitamin D promises to be the most talked-about and written-about supplement of the decade. While studies continue to refine optimal blood levels and recommended dietary amounts, the fact remains that a huge part of the population — from robust newborns to frail elderly, and many of us in between — may be lacking this essential nutrient.

Lack of vitamin D rampant in infants, teens

By Mary Brophy Moran, USA TODAY

Giving your children all they need to grow big and strong may not be as simple as a glass of milk and three square meals. They may be missing an important nutrient that parents have started to pay more attention to: vitamin D deficiency.

Mike Stone joined a growing legion of children diagnosed with the condition when he was 14 years old. Since receiving a vitamin D shot, his symptoms have disappeared.

ON THE WEB: “Vitamin D for Men” offers educational films, free resources.

My doctor thought the machine was broken so that they should take an X-ray on another arm,” says Stone, 22, a recent graduate of Tufts University in Boston. The machine hadn’t broken. Stone was seriously vitamin D deficient, and though the test was “negative” in his case — his blood levels for the doctor’s test — he had to take action. His bones had become previously thin, 50% less dense than they should have been. His doctor immediately put him on vitamin D supplements to correct the problem, Stone said.

Asthma Health Center

Vitamin D May Improve Asthma or Study Links Vitamin D Deficiency and Asthma Seve.
BY CANDICE MANN

Sept. 16, 2010 — Vitamin D is the new “it” vitamin. A number of studies link its deficiency to a host of medical conditions, including heart disease, diabetes, and certain cancers. No review article makes the case for vitamin D supplementation to treat or control asthma more than a recent article in the Annals of Allergy, Asthma, & Immunology.

Researchers reviewed nearly 80 years’ worth of literature on vitamin D, asthma. They found that vitamin D deficiency is linked to increased airway reactivity, lower lung functions, and worse asthma control. Risk factors for vitamin D deficiency include obesity, being African-American, and living in Western countries, the researchers report. These are also populations known to be at risk for developing asthma.

Vitamin D supplementation may improve asthma control by blocking the inflammation-causing proteins in the lung, as well as increasing product protein interleukin-10, which has anti-inflammatory effects, the study said.

The Times

Experts call for Scotland to swallow its vitamin D

Scotland has the lowest public consumption of vitamin D in the UK, according to a study that found levels were 50% lower than in England. Health leaders have called for a campaign to improve public awareness of the vitamin’s importance in preventing osteoporosis and reducing the risk of heart disease.

The study from the Royal College of Physicians of Edinburgh found that Scottish adults had lower vitamin D levels than their English counterparts. The Scottish government has agreed to fund a campaign to encourage people to take vitamin D supplements.
Consumers take initiative!
www.shineonscotland.org.uk

14-year-old petitions Members of Scottish Parliament over vitamin D link to MS

In addition to asking the Scottish government to provide vitamin D for children and pregnant women — in pills or in fortified milk or bread — Shine on Scotland is seeking clarification on the recommended daily allowance of the vitamin and a campaign to inform the public about its benefits in relation to MS.

The Scottish parliament hosted an international conference on Vitamin D and Multiple Sclerosis end of 2010
Women’s yoghurt to maintain bone health
Launched in Spain & Japan

DENSIA
www.danone.com

• Positioning:
  ➤ Women over 40 years old

• Key benefits/claims:
  ➤ Help to maintain bone health
  ➤ Are your bones as strong as you believe?
  ➤ Low fat level

• Key ingredients/composition:
  ➤ Calcium per pot 400 mg (50% RDA)
  ➤ Vitamin D per pot 5µg (100% RDA)

• Retail price:
  ➤ 2.20 US$ or 1.50 €

Yoplait is launching a yoghurt with 50% of Daily value
Estimated cost/serve: 0.00005 USD
Nestlé promotes muscle effect of Vitamin D in protein drink for seniors

Product Benefits

Resource® SeniorActiv contains nutrients commonly deficient in the diet of older adults and helps to:

- Improve nutritional status
- Regain strength and energy after an illness or surgery
- Maintain functional abilities, by supporting physical strength and cognitive health

Product Composition

Resource® SeniorActiv contains Acti-3, a combination of 3 key ingredients to support strength:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Protein</td>
<td>40g in 2 servings</td>
<td>To help minimise muscle breakdown and support muscle synthesis</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>1000 IU in 2 servings</td>
<td>To support muscle strength and optimise bone health</td>
</tr>
<tr>
<td>Calcium</td>
<td>960 mg in 2 servings</td>
<td></td>
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</table>

Vitamin D and calcium are provided in doses clinically proven to reduce the risk of falls and fractures, which are a leading cause of hospitalisation in older adults.

Vitamin D supplementation of 700 – 1000 IU/d is clinically proven to reduce falls and fractures¹,²

<table>
<thead>
<tr>
<th>% REDUCTION</th>
<th>FALLS</th>
<th>NON-VERTEBRAL FRACTURES</th>
<th>HIP FRACTURES</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>-19%</td>
<td>15%</td>
<td>-20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Institutional: 15%</td>
<td>-18%</td>
</tr>
</tbody>
</table>

*Statistically significant
Kids yoghurt with Calcium and Vitamin D (Austria)

Danone - FruchtZwerge

- **Product positioning:**
  - 50% of the bonemass is formed in first 13 years of life
  - Every 2nd child in Austria between 3-6 years does not get enough Calcium and 90% of the kids do not get enough Vitamin D

- **Claims:** FruchtZwerge contains 50% more calcium than milk and contains Vitamin D
Coke’s Vitamin Water with Vitamin D3: Stur-D

Food and supplements for bone health

Coca-Cola launches Vitaminwater Stur-D

By Allison Cerra

WHITESTONE, N.Y. (Oct. 12) Coca-Cola has unveiled a new Vitaminwater drink, which is enhanced with vitamin D.

Vitaminwater Stur-D, a blue agave, passion fruit and citrus-flavored blend, is the first enhanced water and juice beverage to include vitamins C and D and calcium, Coca-Cola said.

"This has truly been an exciting year for the Vitaminwater trademark -- from the successful launch of Vitaminwater zero to a breakthrough in industry innovation like Vitaminwater Stur-D," said Matt Kahn, SVP brand marketing. "These are true testaments to Vitaminwater's commitment to meeting consumers' needs and ever-evolving lifestyles."

Vitaminwater Stur-D will be available on grocery, convenience and drug store shelves for a suggested retail price of $1.49.
Why we all need Vitamin D

What is Vitamin D?

Vitamin D is known as the sunshine vitamin because our skin can produce vitamin D from the sun’s ultra violet light (UVB). It helps control the amount of calcium we absorb therefore and is important for developing and maintaining strong bones.

Why do we need Vitamin D?

A lack of Vitamin D can reduce the body’s ability to absorb calcium, and have a
Kellogg's adds vitamin D to fight rickets after alarming rise in the condition

Kellogg's adds vitamin D to cereal to fight rickets
Kellogg's is to add vitamin D to all its children's cereals in a bid to fight the rise of the condition among young people.

Extra Vitamin D being added to breakfast cereals to help make up for lack of sunlight

by Mike Swain, Daily Mirror 28/10/2011
US consumers have responded
Supplements sales data (excluding Wal-Mart)

Source: IRI data
The future for Vitamin D is bright!
Vitamin D forms

Vitamin D₃: Cholecalciferol

- Naturally occurring form in humans
- Formed by action of ultraviolet light on vitamin D precursors in skin
- Present in certain nutrients and supplements
- Biologically inert
- Conversion (OH) in liver and kidneys produces active form

Vitamin D₂: Ergocalciferol

- Obtained by irradiation of plants or plant materials or foods
- Provided by some dietary sources and multivitamins
- Biologically inert
- Conversion (OH) in liver and kidneys produces active form
- D₂ is less potent than D₃

Parfitt AM, Am J Clin Nutr. 1982
Change in serum 25(OH)D
Following equivalent dose of vitamin D$_3$ or vitamin D$_2$

RCT: 33 healthy adults treated with 50'000 IU Vitamin D (D3 or D2) per week for 12 weeks

Conclusion
- Vitamin D$_3$ is 87% more potent than vitamin D$_2$ in raising and maintaining serum 25(OH)D levels
- 6 weeks after the last dose both groups had lost an appreciable amount of their gain in serum 25(OH)D

Heaney et al 2011
Muscle health - Anti-fall efficacy
Vitamin D₃ more efficacious than vitamin D₂

Meta-analysis of 7 RCTs

Vitamin D > 700 IU

Outcome

Vitamin D > 700 IU reduced relative risk of falls by 19%

Subgroup analysis:
- only VD₃ by 26%
- only VD₂ by 12%

Conclusion

Vitamin D₃ is twice as effective in reducing risk of falls compared to D₂

Bischoff-Ferrari, 2009
Relation between Serum 25(OH)D and Serum PTH

- PTH and 25(OH)D are linked through the Ca-P homeostatic system
- PTH is altered when Ca-P-vit D axis is perturbed and under stress
- Serum PTH decreases by increased vitamin D intake
- Serum PTH and serum 25(OH)D are inversely correlated
- PTH reaches normal range at serum 25(OH)D of 80nmol/l

Conclusion

PTH ranges between 20nmol/l to < 100nmol/l

PTH: Parathyroid Hormone

**PTH Suppression**

*Following equivalent single dose of vitamin D$_3$ or vitamin D$_2$*

RCT: 32 elderly administered a single dose of 300,000 IU VD and followed for 60 days.

### Conclusion

- A sharp decrease in serum PTH with D3 within first 3 days
- D2 reveals only a slight change on the PTH serum level across the entire follow-up period
- D3 is superior and is significant in lowering serum PTH levels

**PTH**: Parathyroid Hormone

*Adapted from Romagnoli 2008 J Clin Endocrinol Metab*