



Healthwise Congress

Role of nutrients for health and well-being - the view of an ingredient supplier

October 31, 2014

Dr. Manfred Eggersdorfer
Nutrition Science & Advocacy DSM

To start with a motivating quote

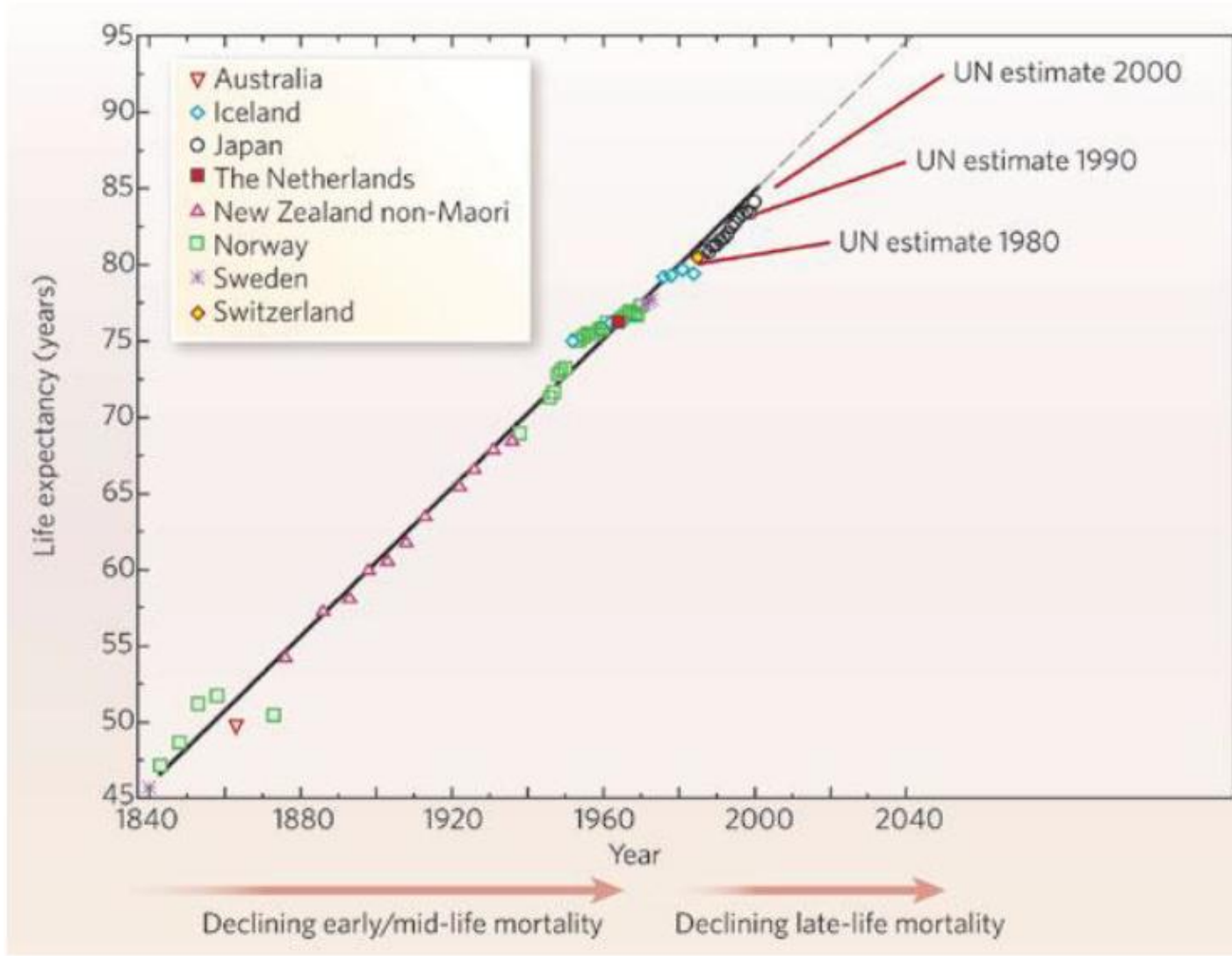


When diet is wrong,
medicine is of no use.

When diet is correct,
medicine is of no need.

Healthy living - the good news

declining late - life mortality



Source: Nature 2008, 451, 644-647

Life expectancy: Japanese females and Iceland men living longest of all

Top 10 countries; life expectancy in years

Women

| | |
|-----------------|------|
| 1. Japan | 87.0 |
| 2. Spain | 85.1 |
| 3. Switzerland | 85.1 |
| 4. Singapore | 85.1 |
| 5. Italy | 85.0 |
| 6. France | 84.9 |
| 7. Australia | 84.6 |
| 8. Rep of Korea | 84.6 |
| 9. Luxembourg | 84.1 |
| 10. Portugal | 84.0 |

....

| | |
|-------------|----|
| Netherlands | 83 |
|-------------|----|

Men

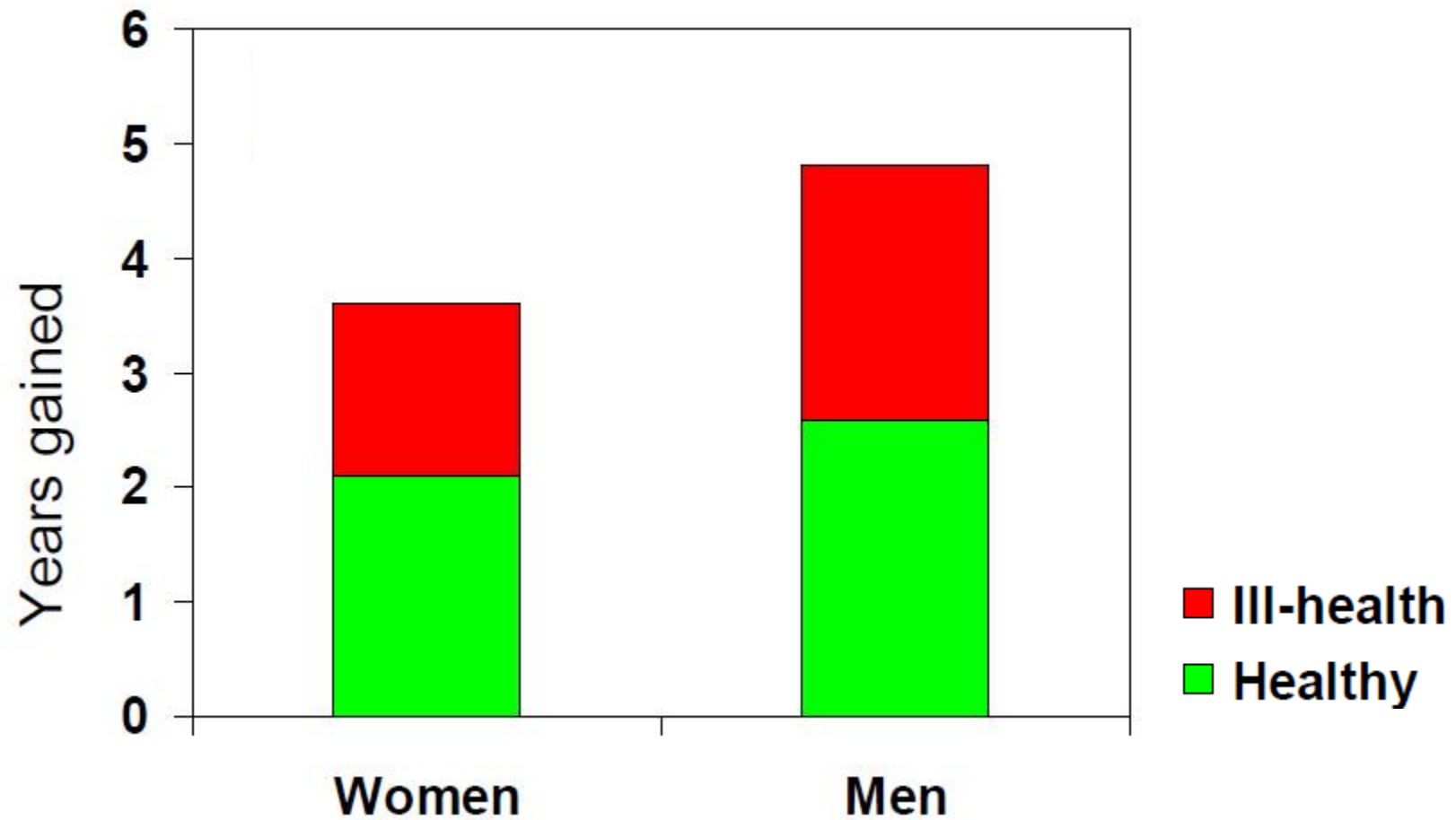
| | |
|----------------|------|
| 1. Iceland | 81.2 |
| 2. Switzerland | 80.7 |
| 3. Australia | 80.5 |
| 4. Israel | 80.2 |
| 5. Singapore | 80.2 |
| 6. New Zealand | 80.2 |
| 7. Italy | 80.0 |
| 8. Japan | 80.0 |
| 9. Schweden | 80.0 |
| 10. Luxembourg | 79.7 |

....

| | |
|-------------|----|
| Netherlands | 79 |
|-------------|----|

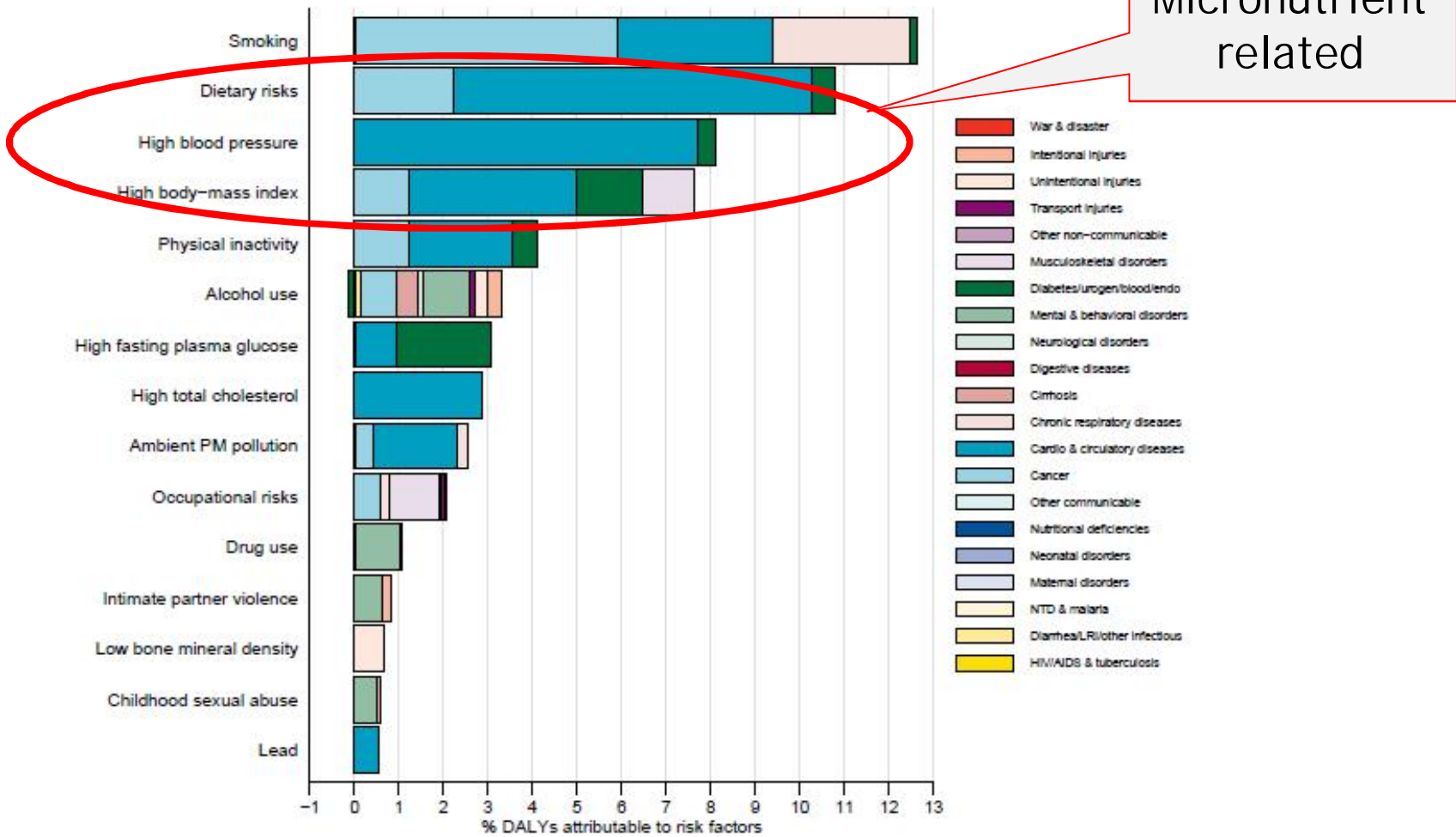
Source: WHO 2014

Gain in life years is not matched by gain of years in good health (1990 -2010)



Source Lancet 2012

Leading risk factors for disease: example Netherlands (2010)

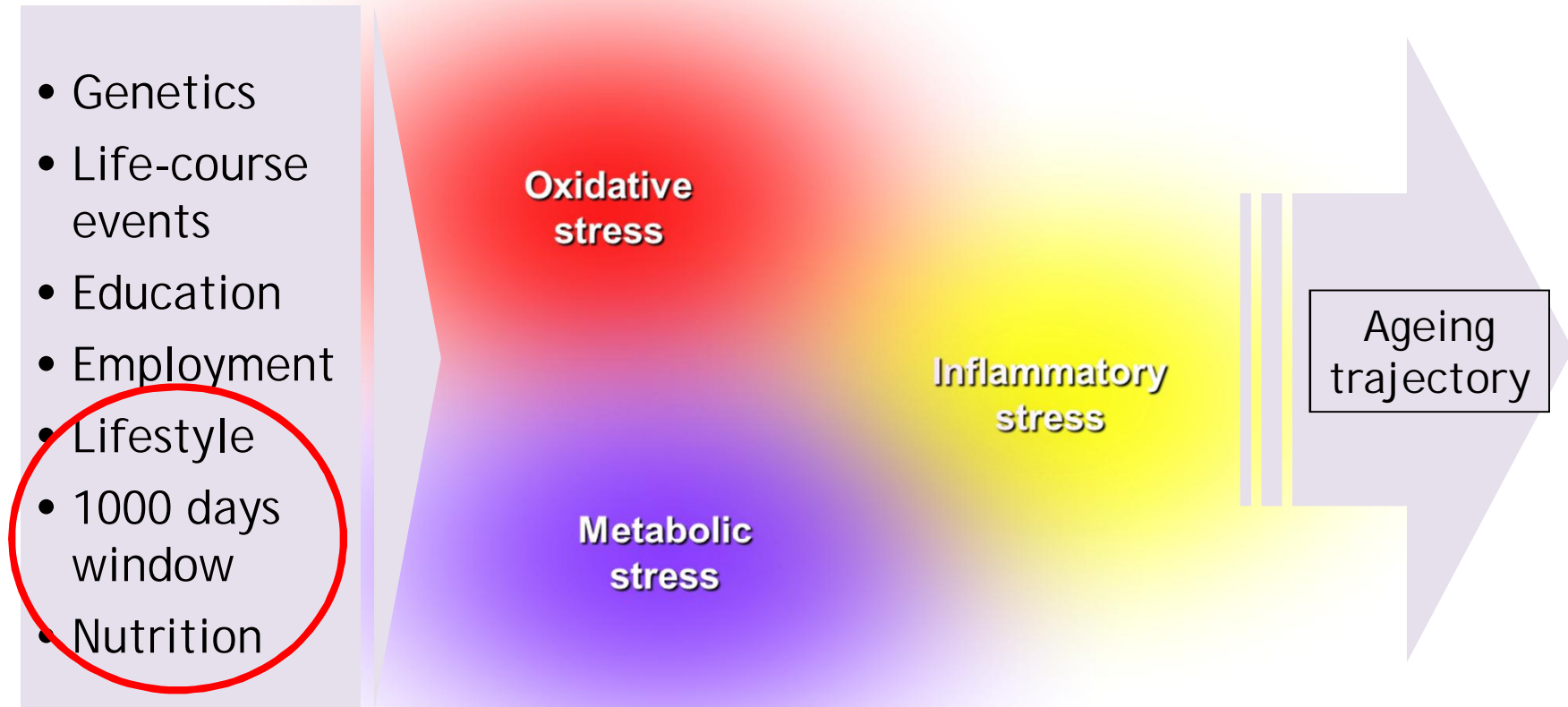


Source: GBD Country Report Netherlands

- **More than 40% of nutrition related diseases take place before the age of 70.**
- **Approximately one third of cancers can be prevented**
- **Up to 80% of heart disease, stroke and diabetes type 2 deaths are preventable.**

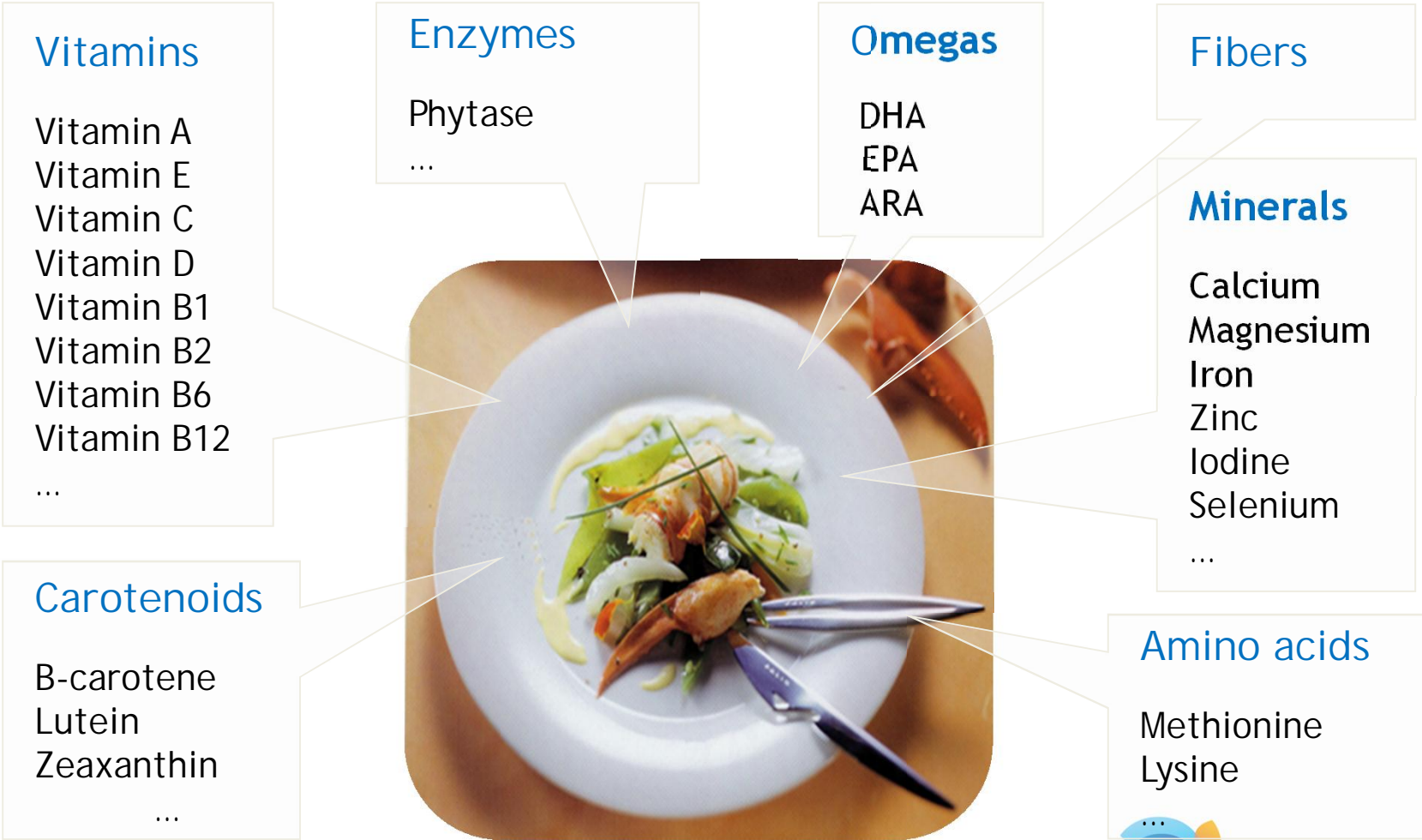
Source WHO

Healthy life depends on several factors - nutrition being an important one

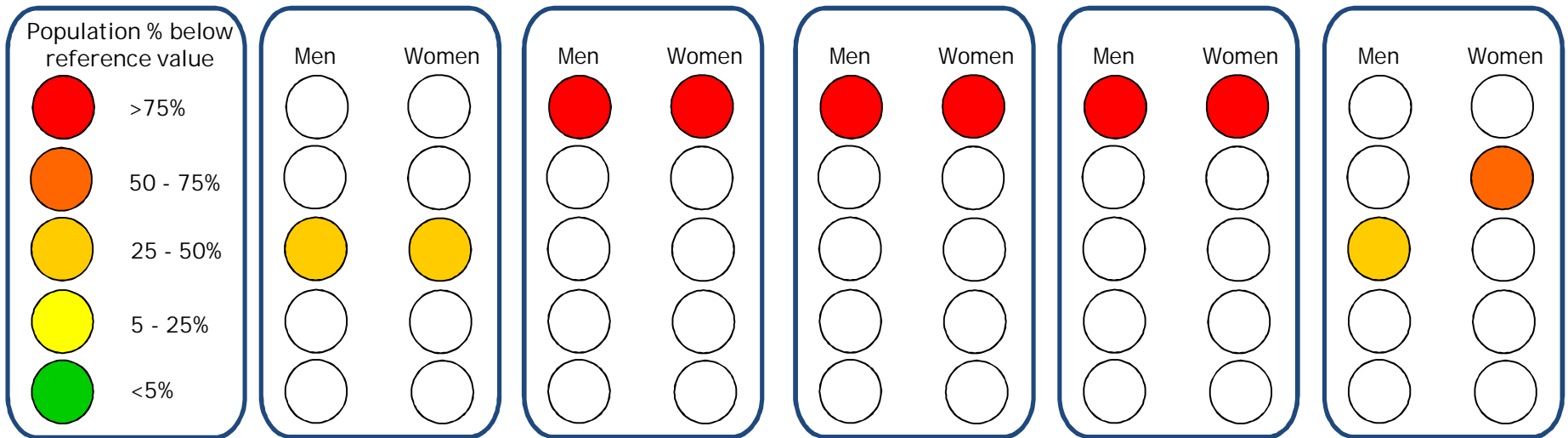


Nutrition and lifestyle are modifiable risk factors

People expect quality and all nutrients in their food

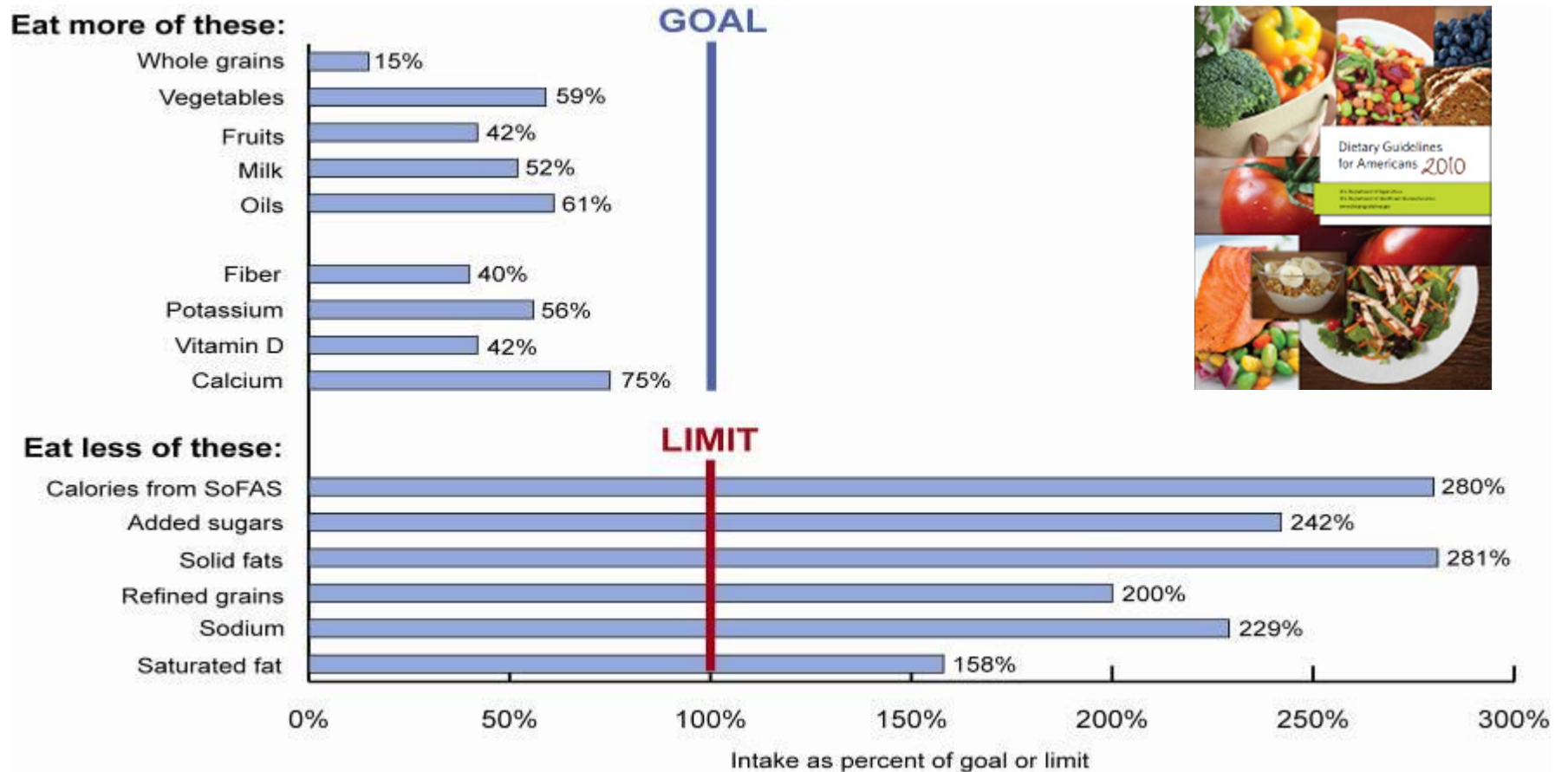


Little compliance with food guidelines - people eat the 'wrong things'!



A large majority of the population does not meet the nutritional recommendations set by the food pyramid

People make wrong choices in nutrition



© 2011 Institute of Food Technologists

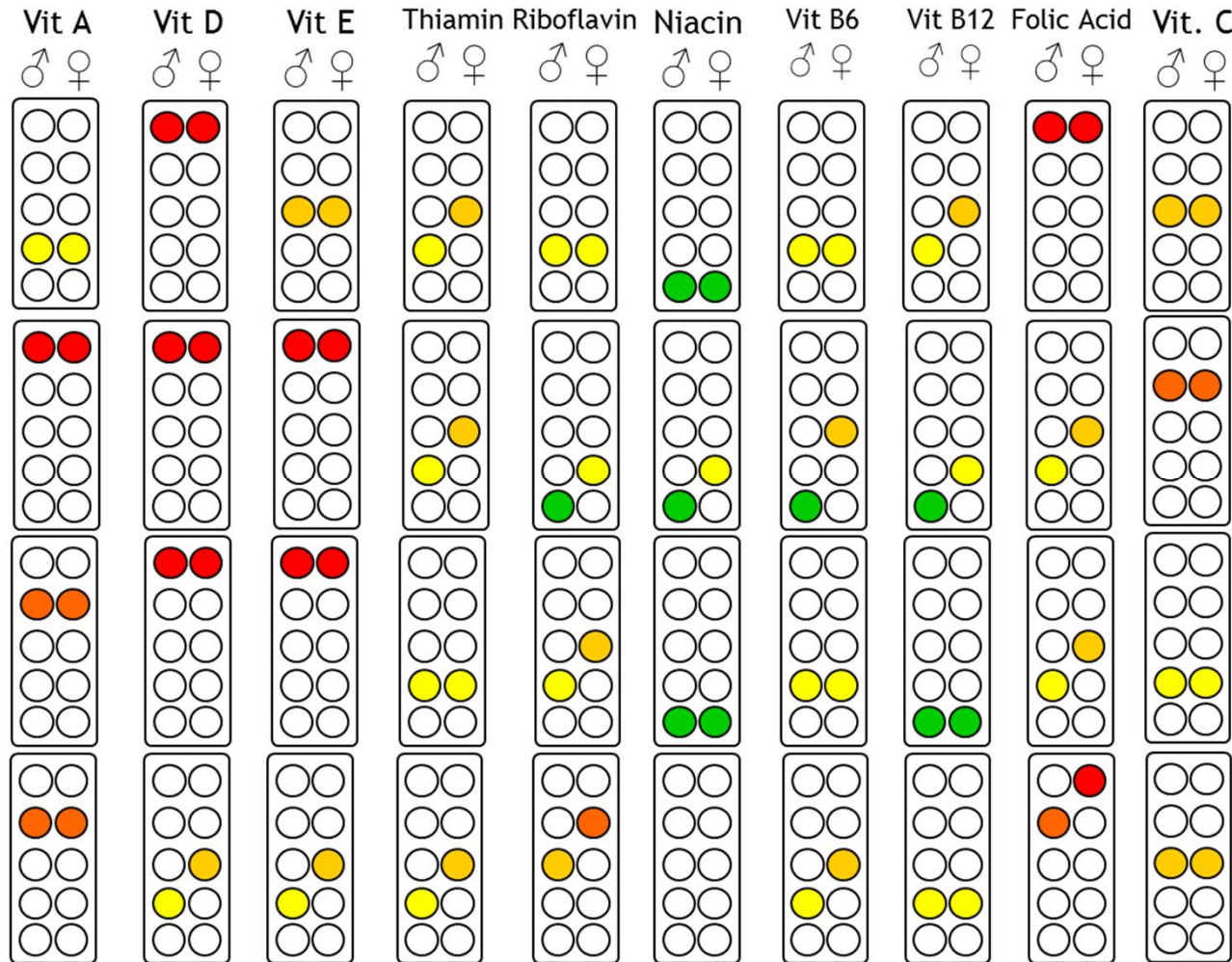
Large-scale population-based dietary intake surveys

- **Nationale Verzehrsstudie II (7'093 men & 8'278 women)**
Max Rubner-Institut. (2008) Nationale Verzehrsstudie II
- **British National Diet and Nutrition Survey (628 men & 672 women)**
Henderson L et al. (2003) Volume 3- Vitamin and Mineral intake and urinary analytes
- **Dutch National Food Consumption Survey 2007-2010 (704 men & 698 women)**
van Rossum CTM et al. (2011) Dutch National Food Consumption Survey 2007-2010- Diet of children and adults aged 7 to 69 years
- **NHANES 2003 - 2008 (3'944 men & 3'641 women)**
Centers for Disease Control and Prevention, National Center for Health Statistics. NHANES 2003 - 2008. Available from: Available from http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/diet03_04.htm

Micronutrient intake is a topic in Western countries



Barbara Troesch, Birgit Hoefft, Michael McBurney, Manfred Eggersdorfer and Peter Weber Published in British Journal of Nutrition 2012, 108, pp 692-698



Germany

United States

United Kingdom





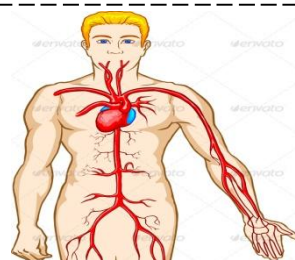
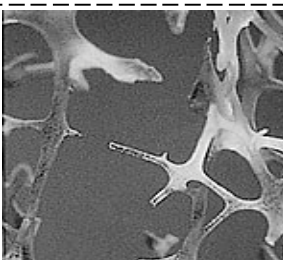
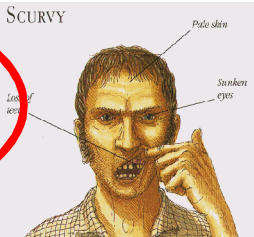
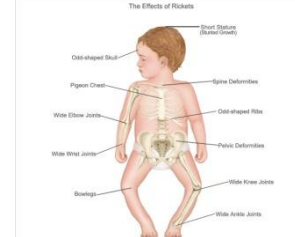

The Netherlands

● <5%, ● 5-25%, ● >25-50%, ● >50-75%, ● >75% below recommendations



The consequences: inadequate micronutrient intake affects health and performance

Nutrient status Metabolic response

| | | | | |
|--------------|---|--|--|--|
| Desirable | Long term health, wellness, vitality |  |  |  |
| Insufficient | Impaired functions, higher risk for non-communicable diseases |  |  |  |
| Deficient | Deficiency disease |  |  |  |

A balanced intake of all essential nutrients is required for long-term health, healthy aging and risk reduction of NCDs

Adapted from B. Ames

Example of a deficiency disease - which is still an issue in major parts of the world

Babies born annually with NTD

- 300,000 to 400,000 worldwide (Christianson A, et al., (2006))
- ~4,500 in Europe (J Behav Med 25:411-424)
- 100,000 in China (N Engl J Med 341:1509-1519)

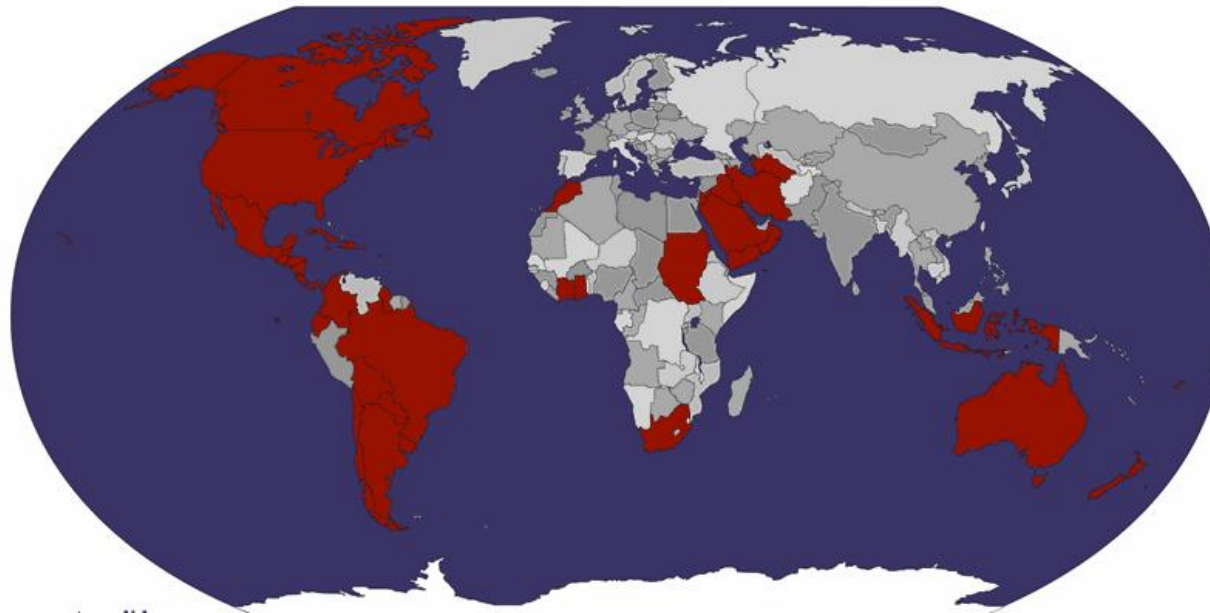
The impact and solution

- The average life time costs (including quality of life and life expectancy) for a child with an NTD amounts to : € 242,948
- Food fortification with folic acid is a cost effective and humanitarian countermeasure (Jentik et al. (2008))

In the light of many countries experiences with folic acid fortification it is timely to advocate in countries with no fortification.

Several hundreds of millions Euros of savings were estimated as cost benefit for folic acid fortification – next to the ethical aspects.

Many countries (in red) have mandatory fortification of food with folic acid in place



The following countries have mandatory fortification of food with folic acid.

- | | | |
|--------------------|-------------|-------------------------------|
| Argentina | Ghana | Oman |
| Australia | Grenada | Palestine, Occupied Territory |
| Bahrain | Guadelupe | Paraguay |
| Barbados | Guatemala | Puerto Rico |
| Belize | Guyana | Qatar |
| Bolivia | Haiti | Saudi Arabia |
| Brazil | Honduras | South Africa |
| Canada | Indonesia | St Vincent |
| Chile | Iran | Sudan |
| Colombia | Iraq | Turkmenistan |
| Costa Rica | Jamaica | Uruguay |
| Cote d'Ivoire | Jordan | USA |
| Cuba | Kuwait | Yemen |
| Dominican Republic | Mexico | |
| Ecuador | Morocco | |
| El Salvador | New Zealand | |
| Fiji | Nicaragua | |

<http://www.eurocat-network.eu/preventionandriskfactors/folicacid/folicacidmandatoryfortification>

However two third of the countries miss the opportunity of fortification



Insufficient intake of essential nutrients increases risk for non-communicable diseases

| | Vitamin A | β -Carotene | Thiamine | Riboflavin | Niacin | Vitamin B5 | Vitamin B6 | Vitamin B12 | Folate | Biotin | Vitamin C | Vitamin D | Vitamin E | Vitamin K | Dietary AO | Multivitamin | PUFA |
|--------------|-----------|-------------------|----------|------------|--------|------------|------------|-------------|--------|--------|-----------|-----------|-----------|-----------|------------|--------------|------|
| Aging | ● | ● | | ● | ● | ● | ● | ● | ● | | ● | | ● | | ● | | |
| Cancer | | ● | | | | | ● | ● | ● | | ● | ● | ● | | ● | ● | ● |
| Dementia | | | | | | | ● | ● | ● | | | ● | | | | | |
| Bone Health | | | | | | | | | | | ● | ● | | ● | | | ● |
| Hypertension | | | | | | | | | | | ● | ● | | | | | ● |
| Diabetes | | | ● | | | | | | | | ● | ● | | | ● | | |
| CVD | ● | | | | | | ● | | ● | | | ● | | | ● | ● | ● |
| COPD | ● | | | | | | | | | | ● | ● | ● | | ● | | ● |
| AMD | | | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | | | | ● |

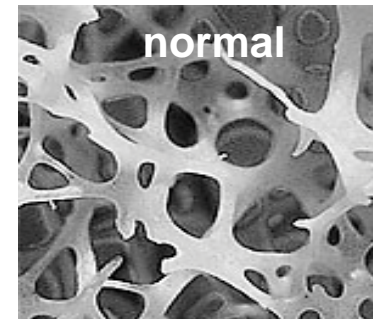
Source: internal data DSM



Example Vitamin D: 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



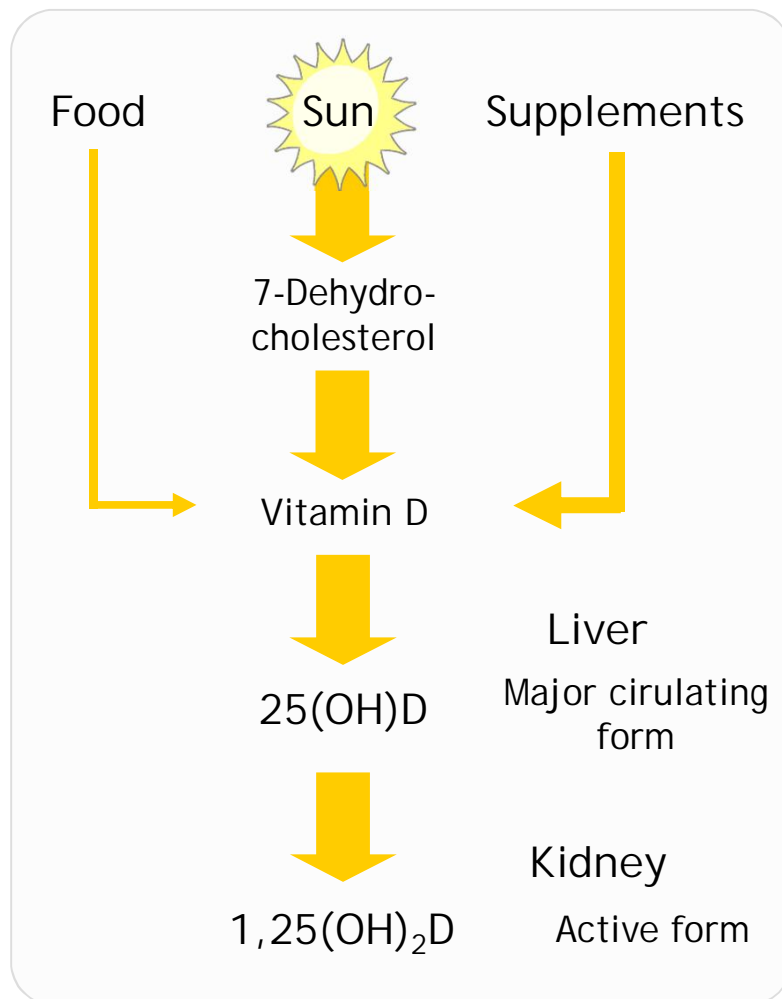
Emerging health benefits of vitamin D

- Muscle
 - Reduces risk of falling by improving muscle strength
- Immunity
 - Strengthens the immune system
 - Reduces risk of multiple sclerosis and diabetes type
- Cardiovascular
 - Lowers blood pressure
- Cancer
 - Inhibits cell proliferation



Vitamin D comes from different sources

Serum level is an indicator for individual status



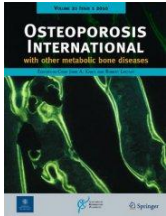
25(OH)D serum level (nmol/L) is a sensitive indicator of Vitamin D status (IOM 1997)

Four ranges are suggested to assess the individual status:

(nmol/L)

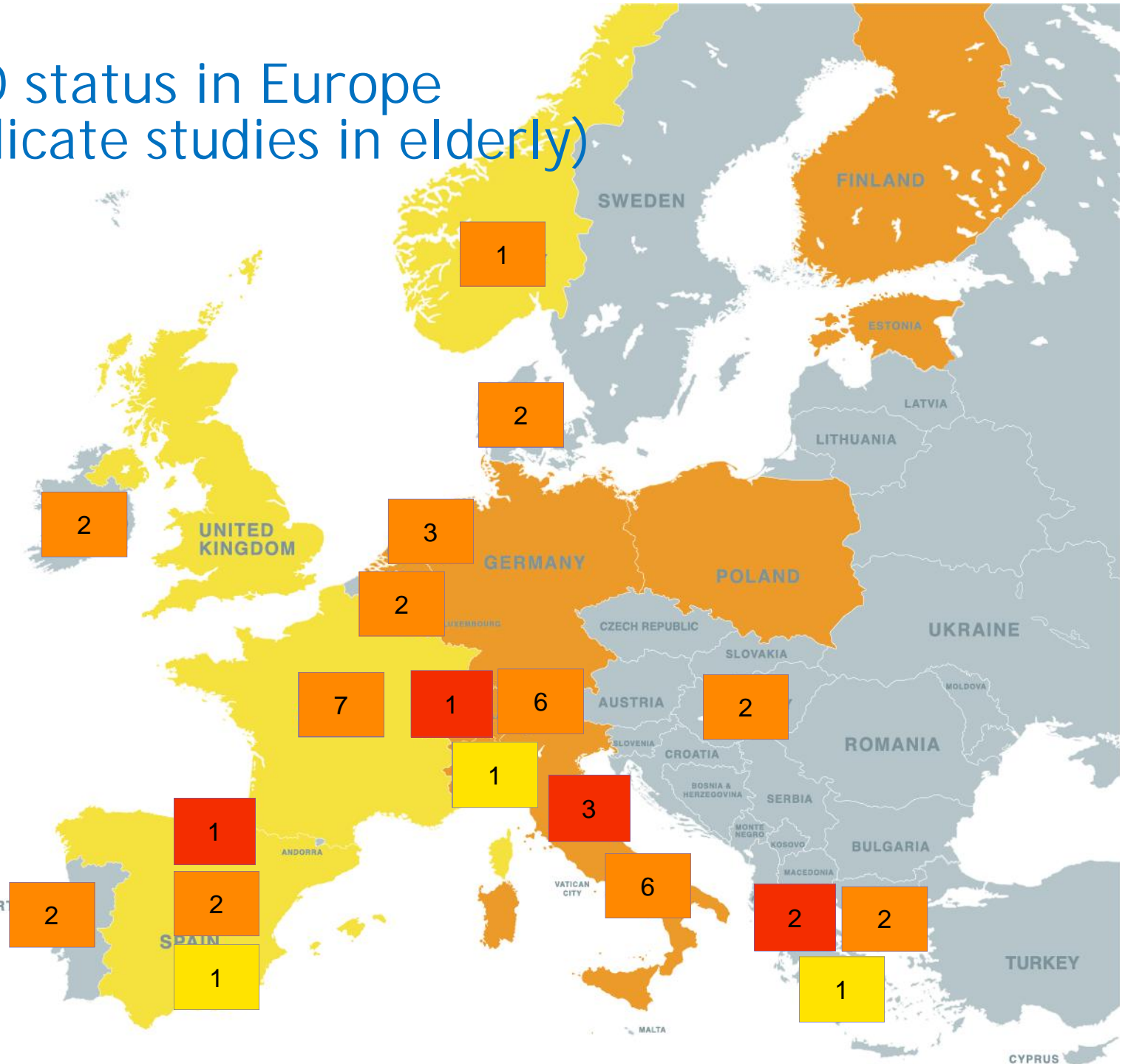
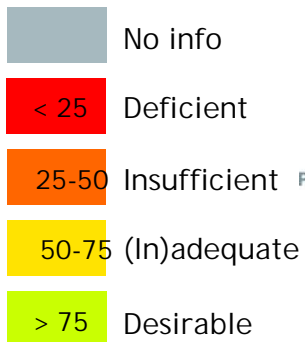
| | | | |
|-----------|--------------|--------------|-----------|
| < 25 | 25 - 50 | 50 - 75 | > 75 |
| deficient | insufficient | (in)adequate | desirable |

Vitamin D status in Europe (boxes indicate studies in elderly)



Reference:
 E. M. Brouwer-Brolsma, H. A. Bischoff-Ferrari, R. Bouillon, E. J. M. Feskens, C. J. Gallagher, E. Hypponen, D. J. Llewellyn, E. Stoecklin, J. Dierkes, A. K. Kies, F. J. Kok, C. Lamberg-Allardt, U. Moser, S. Pilz, W. H. Saris, N. M. van Schoor, P. Weber, R. Witkamp, A. Zitterman, L. C. P. G. M. de Groot, Osteoporosis Int 2012

Vitamin D levels
in nmol/l



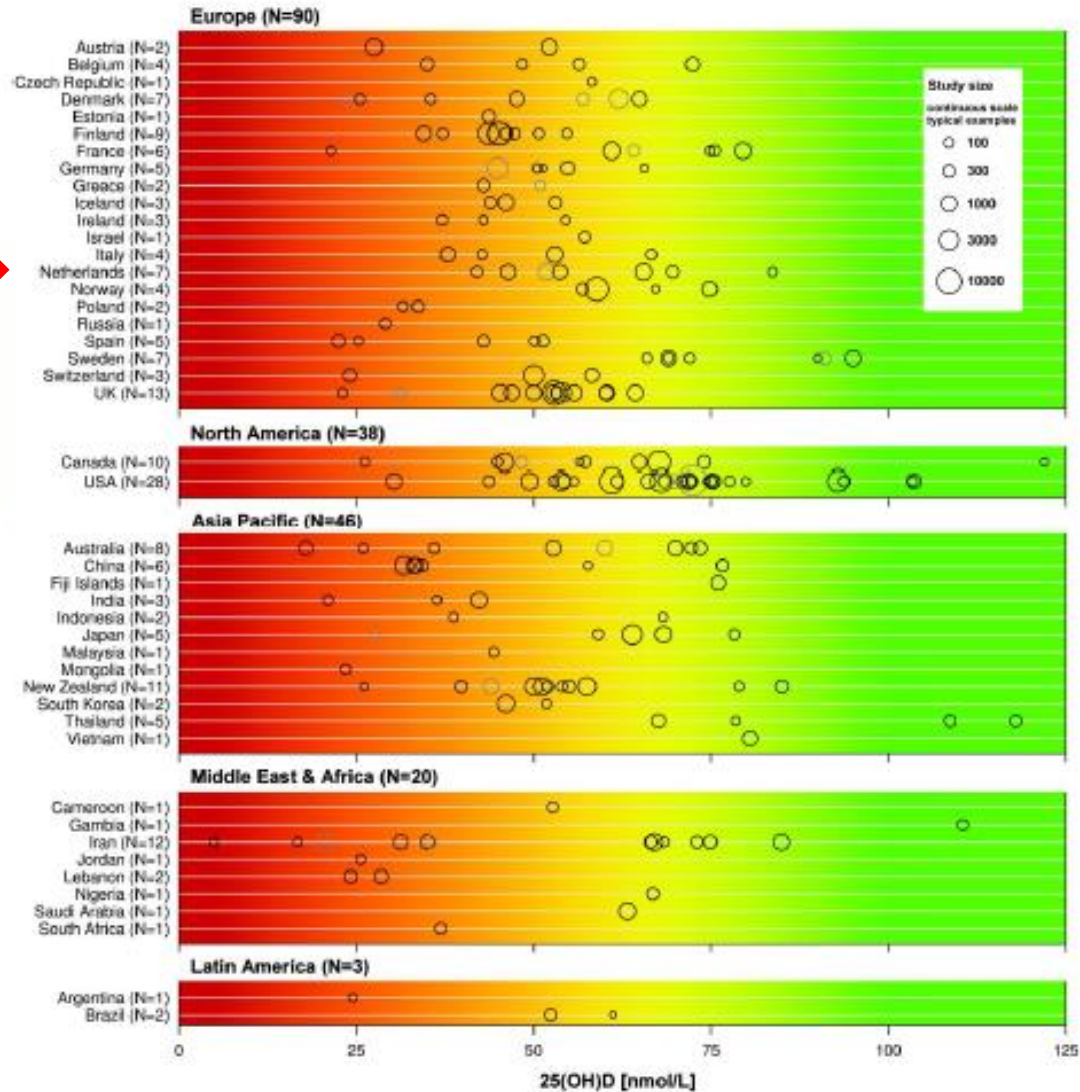
A systematic review of vitamin D status in population worldwide

Mean 25(OH)D levels.

- 6.7% below 25 nmol/l
- 37.3% below 50 nmol/l
- 88.1% below 75 nmol/l



Reference:
 J. Hilger, Angelika, F. Raphael
 Herr, T. Rausch, F. Roos, D.A.
 Wahl, D.D. Pierroz, P. Weber, K.
 Hoffmann, BJN 2013



What are potential consequences of low vitamin D status?

One in three women and one in five men over the age of 50 years will sustain an osteoporotic fracture

In women, the incidence of fractures is higher than the total incidence of cancer, heart infarction, stroke or diabetes

Germany: Health care cost impact of low vitamin D status

Hip and vertebral fractures have the most „cost-intense“ medical implications

- Number osteoporosis patients: 8-10 mio (2010)*
- Number of hip and vertebral fractures p.a.: 150.000*


Optimized vitamin-D status reduces number of fractures by 20 %

- Reduction of 5.478 hip fractures and 18.420 less vertebral fractures (in osteoporosis-diagnosed population)

Net socio-economic benefit ranges from* :  585 mio €

Including medical and therapeutic costs for prevention, treatment and supplementation costs vitamin D

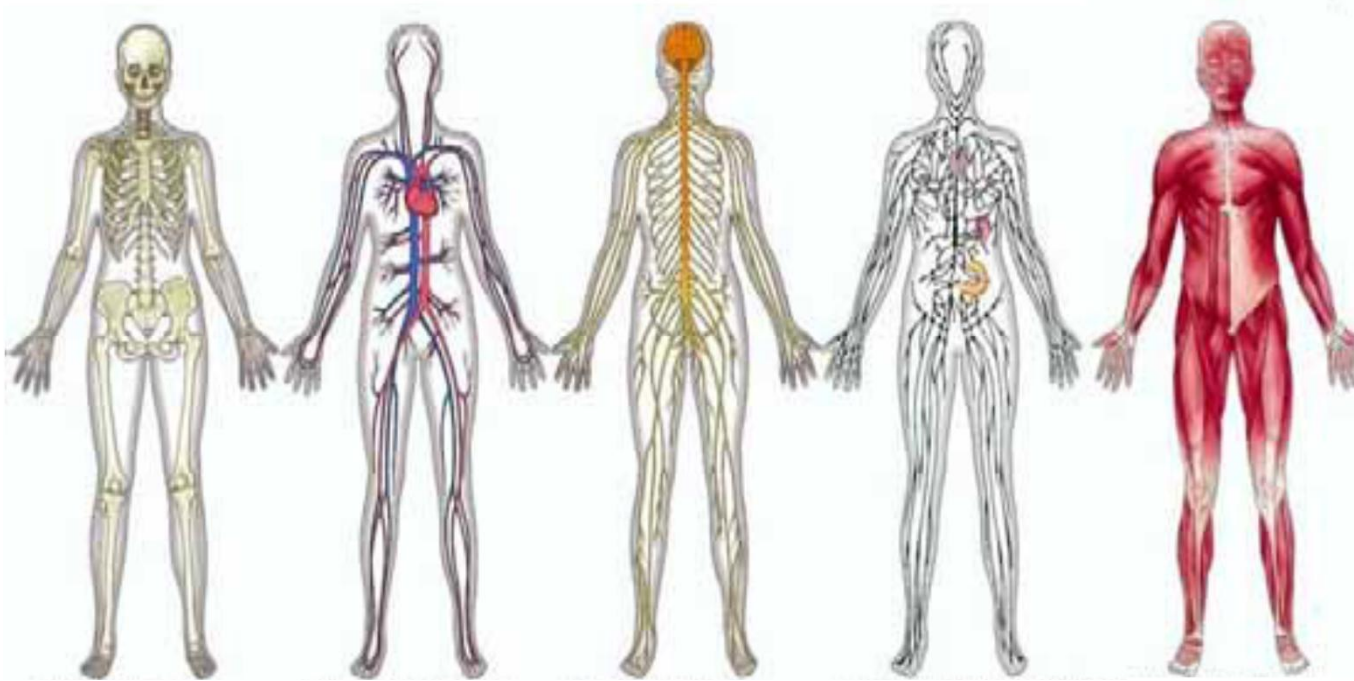
up to

 778 mio €

Including societal perspective, e.g. family care, reha costs

Costs of vit D supplementation for women > 55 with low vit D status: 180 -200 mio EUR

Magnitude of vitamin D considering additional health benefits



Risk reduction by optimal vitamin status:

| | | | | |
|----------------|--------------------------|--------------------|----------|-------------------|
| Bone fractures | Cardio Vascular Diseases | Multiple Sclerosis | Diabetes | Cancer and others |
| 20 % | 20 % | 50% | 25% | 25 % |

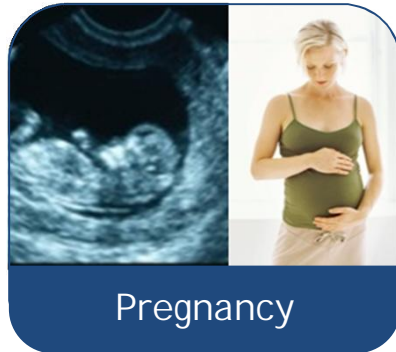
Large health care cost savings could be achieved with adequate vitamin D status

| | | | |
|-------------|------|--|-------------|
| Zittermann | 2010 | Germany: overall perspective, including direct and indirect costs and implications | € 37,5 bn/y |
| Grant et al | 2009 | 17 countries in Europe: direct and indirect cost savings (= 16,7 % of total health care costs) | € 187 bn/y |

Adequate levels can be achieved with voluntary food fortification and/or supplementation for risk groups with costs of only 20-30 EUR/person per year

Source: vitamin D and socioeconomic costs, T. Sproll

Example omegas: required over the life cycle



Pregnancy

Maternal health

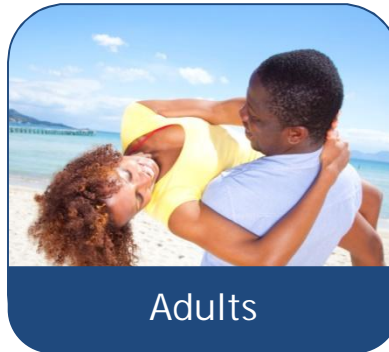
- Promotes maternal DHA status
- Increases DHA content of breast milk
- Supports normal gestation period
- Promotes fetal brain and eye development



Infants & Toddlers

Brain/eye development

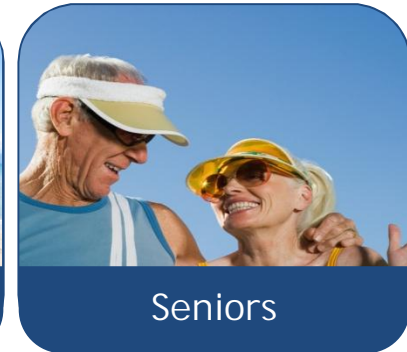
- Improves visual acuity
- Promotes cognitive development
- Reduces risk of overweight and obesity



Adults

Heart Health

- Lowers triglycerides
- Increases HDL
- Improves blood vessel function
- Normal cardiac function



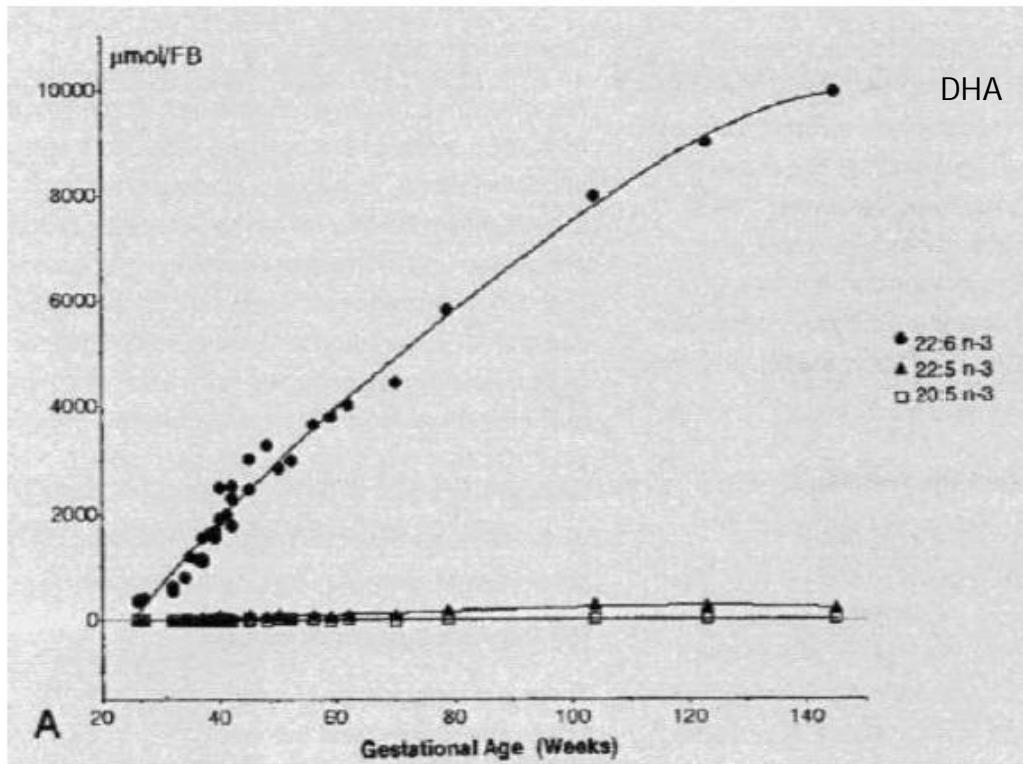
Seniors

Brain & Eye Health

- Reduced cognitive decline
- Lower risk of dementia
- Lower risk of age-related macular degeneration

Omegas play a vital role over the full life cycle

DHA is important during pregnancy and the first two years



DHA very important during last trimester of pregnancy and during first 2 years of life

So, are pregnant women consuming the recommended intakes of DHA?

Recommended DHA intake for pregnant and lactating women =

at least 200 mg DHA per day

Koletzko et al, Br J Nutr 2007; 98:873-877.

However only median intake of 75 mg DHA/day reported!

Cosatto et al, Nutrients 2010; 2(2): 198-213



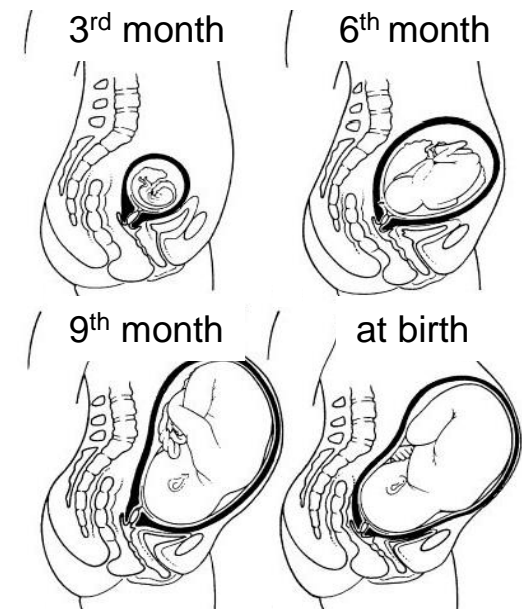
Achieving the recommended intake of 200 mg DHA is a challenge

| Food Source | Amount to consume to deliver 200mg DHA |
|-------------------------------|---|
| Canned Red Salmon (in water) | 15g |
| Canned Pink Salmon (in water) | 33g |
| Atlantic Salmon | 53g |
| Salmon, smoked | 69g |
| Australian Salmon | 86g |
| Canned tuna (in water) | 97g |
| Tuna, bluefin | 100g |
| Mussels, blue | 120g |
| Scallops | 167g |
| Tuna Yellow Fin | 200g |
| Whiting | 333g |
| Flake steamed | 400g |
| King Prawns | 400g |
| Boiled eggs | 444g or 7-8 eggs |
| Lamb leg steak | 2500g |
| Beef rump steak | 6667g or 25-30 steaks |

So using fortified foods or taking a supplement with DHA may be a wise choice!

Cognitive health benefits of DHA supplementation during pregnancy & lactation

- High-dosage supplementation of long-chain polyunsaturated fatty acids (particularly DHA) in mothers, started at mid-pregnancy, has been associated with long-term positive effects on intelligence quotient scores of neurodevelopment.
(*Early Human Development 86 (2010) S3-S6*)
- Five-year-old children whose mothers received modest DHA supplementation versus placebo for the first 4 months of breastfeeding performed better on a test of sustained attention.
- This, suggests that DHA intake during early infancy confers long-term benefits on specific aspects of neurodevelopment.
(*J Pediatr 2010*)



Youngson (1995) *Encyclopedia of family health*

LC-PUFAs support growth and development

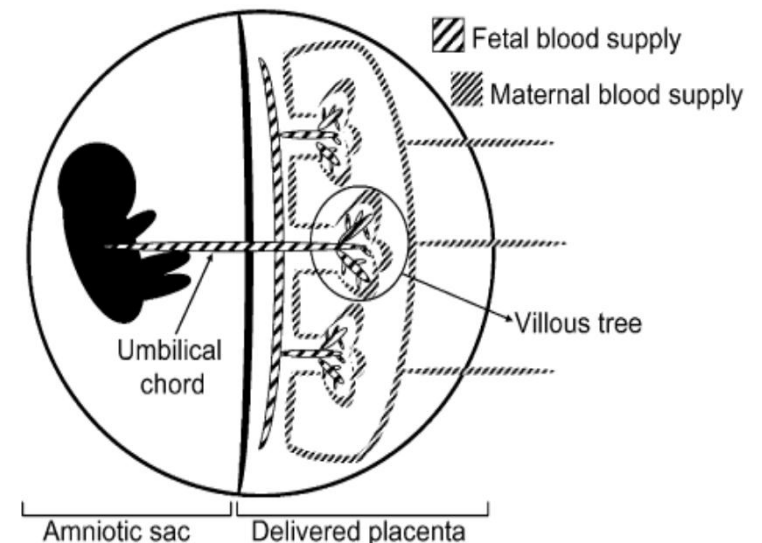
DHA and AA are important for fetal development

- DHA is essential for development of fetal brain and retina.
- AA is important for normal development of organs and cells.
- PUFAs are not synthesized by the fetus, but taken from maternal blood supply and accumulated in the fetus during gestation.

LC-PUFAs are needed for growth of the placenta. Further demands are made on the mother's fatty acid supply as the placenta and the fetus grows.

Long-chain polyunsaturated fatty acids (LC-PUFA), Docosahexaenoic acid (DHA)
Arachidonic acid (AA), Prostaglandin E2 (PGE2)

Cunningham and McDermott, 2008



Solutions are available

- Education in healthy nutrition
- Incentive programs
- Food fortification
- Biofortification
- Supplementation



Not one solution will eliminate deficiencies and inadequate intake - it is about the right ratio between the approaches, depending on the country, nutrition status and other factors

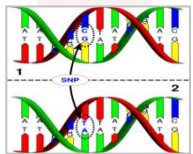


Roadmap for a nutritious diet for all

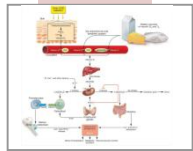
Current status



1. Assess micronutrient intake & status in different regions/population groups



2. Explore impact on health and risk for nutrition-related diseases



3. Assess impact on health care and economic development



4. Develop, advocate and facilitate adequate fortification and supplementation tailored to countries and populations

Nutrition for a healthy life

Who has health has hope,
who has hope has everything

Thank you!

manfred.eggisdorfer@dsm.com



Please visit
www.vitaminsinmotion.com

