Vitamins; do we need supplements?

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What are vitamins ?

- Nutrients that our body cannot make on its own, usually small organic molecules in very small amounts. Thus we must obtain them from the foods we eat, (or via vitamin supplements).

- **They are essential for maintaining good health and are necessary for many life functions.**

Poll:

1) Which vitamins do you know?

2) Who took any kind of vitamin supplement, pill, or drink yesterday or this morning? CC-Lemon, and similar vitamin mix containing boost drinks count too!!!

3) Who takes regularly (for example already this month or week) any kind of vitamin supplements, pills, or drinks?

A big industry has evolved around vitamin supplements and I will come back to more numbers on vitamin business and usage in Japan and the world a bit later. Lets also compare these numbers with our poll!

A recent New York Times article asked,
“Should We Toss Our Vitamin Pills?”

The New York Times, RONI CARYN RABIN, DECEMBER 16, 2013;
print on 12/17/2013, on page D6 of the NewYork edition with the headline:
A Challenge to Vitamins.

Vitamins - discovery

- Polish biochemist Casimir Funk discovered vitamin B1 in 1912 in rice bran (the outer husk).
- He proposed the organic molecule be named "Vitamin" (vital amines). Amines are organic molecules that contain an „amino – NH_2-group“
- By the time it was shown that not all vitamins were *amines*, the word was already used everywhere.

Vitamins – Biological functions

- Vitamins have very diverse biological functions:
  - hormone-like functions as regulators of mineral metabolism (vit. D)
  - regulators of cell and tissue growth and differentiation (some forms of vit. A)
  - antioxidants (vit. E, C), that fight off free-radicals in our bodies.
  - enzyme cofactors (tightly bound to enzyme as a part of prosthetic group, coenzymes) Some B vitamins

Vitamin classification

Fat- or Lipid-soluble vitamins (A, D, E and K)

- Hydrophobic (water repelling) compounds, absorbed efficiently with fats (lipids),
- transport in the blood in lipoproteins or attached to *specific binding proteins,*
- more likely to accumulate in the body,
- more likely to lead to *hypervitaminosis* meaning too much of a vitamin. Excess is stored in the liver and in body fat
- It is possible to build up a toxic level !

Vitamin classification

Water-soluble vitamins - 8 B vitamins and vitamin C

- Function: mainly as enzyme cofactors,
- Hydrophilic (water loving) compounds dissolve easily in water,
- Not readily stored, excreted from the body through urine
- Their consistent daily intake is important.

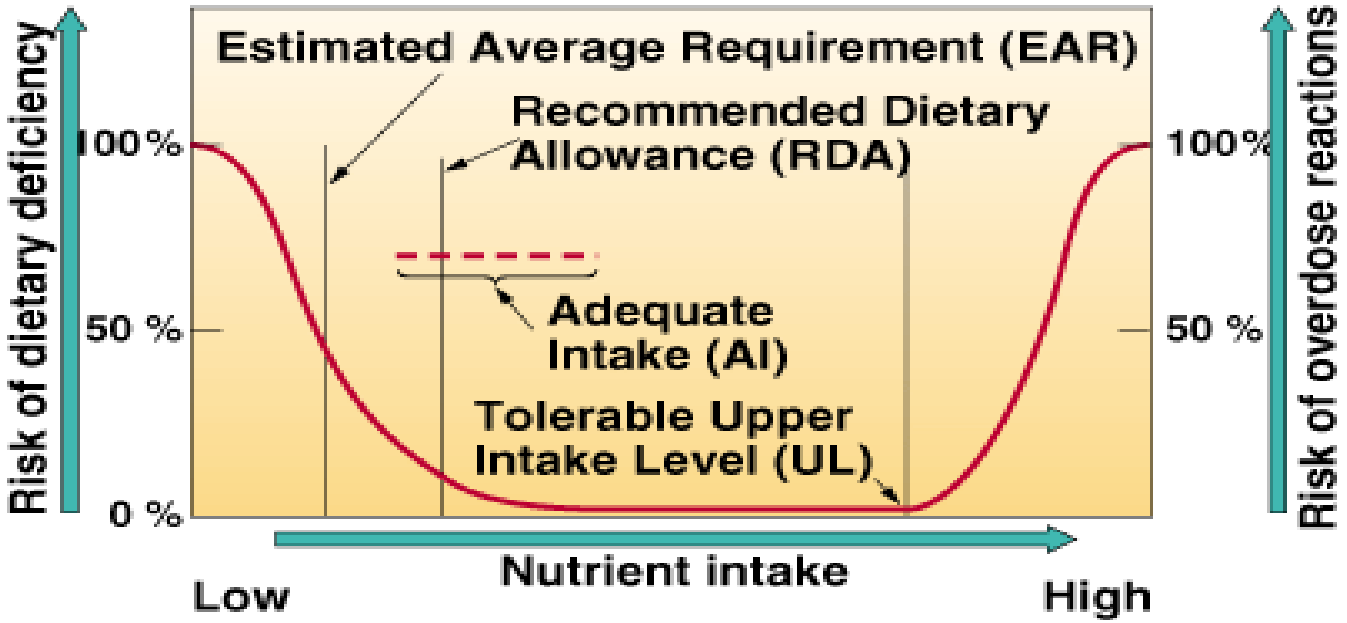
Many types of water-soluble vitamins are synthesized by bacteria.

Vitamins: How much should I get each day?

Reference Daily Intake (RDI), formerly called Recommended Dietary Allowance (RDA).

- daily dietary intake level of a nutrient considered sufficient to meet the requirements of nearly all (97–98%) healthy individuals in each life-stage and gender group
- a collaborative effort between the USA and Canada
- RDI is used to determine the Recommended Daily Value **(RDV)**
- Uses of RDV include
  - food labels
  - composition of diets for schools, prisons, hospitals or nursing homes

- The **DRI** is the recommended intake level
  - Some vitamin DRI's are an **RDA** (Recommended Dietary Allowance) some are an **AI** (Adequate Intake)
  - The Tolerable Upper Intake Level (**UL**) is the highest amount that is likely not to cause harm for most healthy people when consumed daily



- Because vitamins are mostly organic molecules, they can be destroyed and left unable to function
  - Heat – keep food refrigerated, don't over cook
  - Light (ultraviolet) – store in opaque containers
  - Oxygen – after cut (fruits, vegetables), keep airtight
  - Some water soluble – cook shorter with less water
- The body needs vitamins in small amounts
  - Milligrams (mg) or micrograms (µg) instead of grams (g)
  - Although needed in small amounts, vitamins are needed on a regular basis.

1 g = 1000 mg = 100000 µg

Vitamins: How much should I get each day?

https://bit.ly/2SGsCxD 2019/03/04

Vitamin/Mineral	Daily intake recommendation	What they affect	Where to find them
Vitamin A	700 mcg	Skin, bones, vision, hair	liver, carrot, sweet potato
Vitamin D	15 mcg	bones, immune system	Fatty fishes (catfish, salmon…) egg
Vitamin E	15 mg	skin, vision, hair	Wheat germ oil, sunflower seeds.
Vitamin K	60 mcg	bones, blood	spinach, kale, broccoli
Vitamin C	75 mg	immune system, skin, teeth, hair	Guavas, red pepper, broccoli
Choline	425 mg	Nervous system, brain	egg, beef, cauliflower
Thiamin (B1)	1-1.1 mg	energy, heart, muscles	egg, legumes, whole grains
Riboflavin (B2)	1.1 mg	body growth, energy, hair	Dairy, eggs, greens
Niacin (B3)	14 mg	digestive system, skin, energy	Dairy, eggs, fish
Pantothenic Acid	5 mg	skin, energy	Mushrooms, cauliflower, broccoli
Vitamin B6	1.3 - 1.7 mg	nerve, break down protein, hair	avocado, banana, legumes
Folic Acid/Folate	400 mcg	tissue growth, hair	dark greens, legumes, citrus fruits
Vitamin B12	2.4 mcg	metabolism, hair	eggs, soymilk, poultry
Biotin	no more than 30 mcg	hair, nail, skin	tomaotes, romaine lettuce, carrots

Council for Responsible Nutrition, 2001
1875 Eye Street N.W. Suite 400, Washington, D.C. 20006 • (202) 872-1488

Vitamins: How much should I get each day?

Council for Responsible Nutrition

Vitamins:
Historical Comparison of RDIs, RDAs and DRIs, 1968 to Present

VITAMIN	RDI*	1968 RDA**	1974 RDA**	1980 RDA**	1989 RDA**	DRIs***
Vitamin A	5000 IU	5000 IU	1000 RE (5000 IU)	1000 RE	1000 RE	900 mcg (3000 IU)
Vitamin C	60 mg	60 mg	45 mg	60 mg	60 mg	90 mg
Vitamin D	400 IU (10 mcg)	400 IU (10 mcg)	400 IU (10 mcg)	10 mcg (400 IU)	10 mcg (400 IU)	15 mcg (600 IU)
Vitamin E	30 IU (20 mg)	30 IU (20 mg)	15 IU (10 mg)	10 mg (15 IU)	10 mg (15 IU)	15 mg #
Vitamin K	80 mcg	--	--	70-140 mcg	80 mcg	120 mcg
Thiamin	1.5 mg	1.5 mg	1.5 mg	1.5 mg	1.5 mg	1.2 mg
Riboflavin	1.7 mg	1.7 mg	1.8 mg	1.7 mg	1.8 mg	1.3 mg
Niacin	20 mg	20 mg	20 mg	19 mg	20 mg	16 mg
Vitamin B-6	2 mg	2 mg	2 mg	2.2 mg	2 mg	1.7 mg
Folate	0.4 mg (400 mcg)	400 mcg	400 mcg	400 mcg	200 mcg	400 mcg food, 200 mcg synthetic ##
Vitamin B-12	6 mcg	6 mcg	3 mcg	3 mcg	2 mcg	2.4 mcg ###
Biotin	(300 mcg)	150-300 mcg	100-300 mcg	100-200 mcg	30-100 mcg	30 mcg
Pantothenic	10 mg	5-10 mg	5-10 mg	4-7 mg	4-7 mg	5 mg
Choline	--	--	--	--	--	550 mg

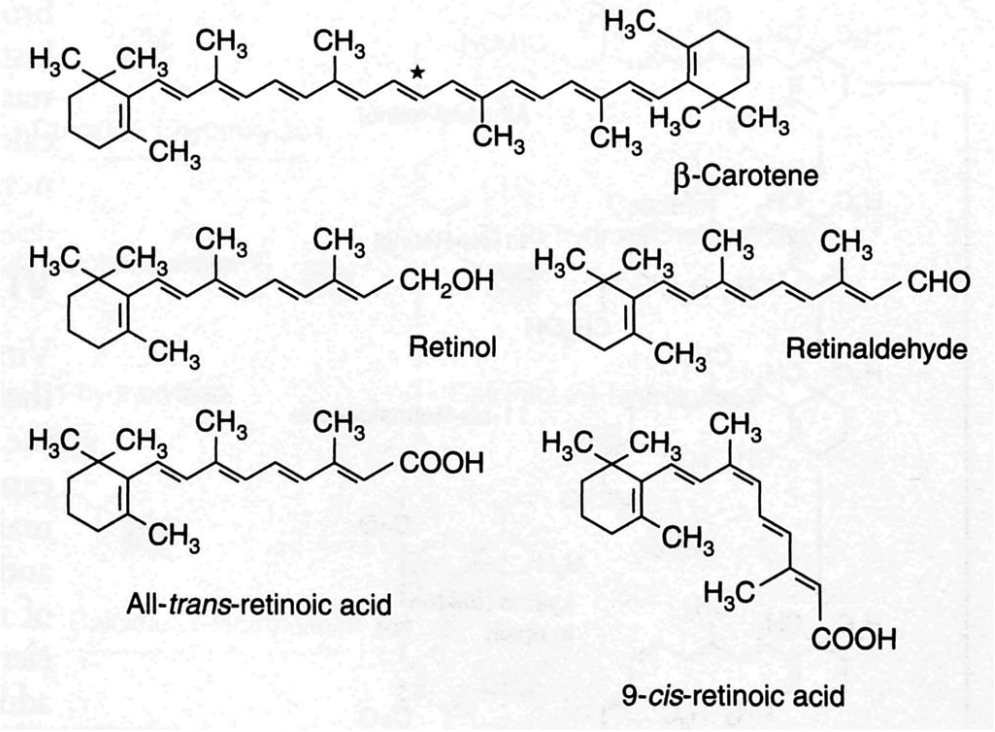
Examples: Lipid-soluble vitamins

Vitamin A

Retinol

- Biologically active forms - *retinoids*: retinol, retinal, retinoid acid.
- Major vit. A precursors (provitamins) → plants *carotenoids*.
- Sources of animals origin contain most of vit. A in the form of esters (retinylpalmi-tates) – *retinol* and *long fatty acid*

Cyclohexen ring and isoprenoid chain



Sources of vitamin A

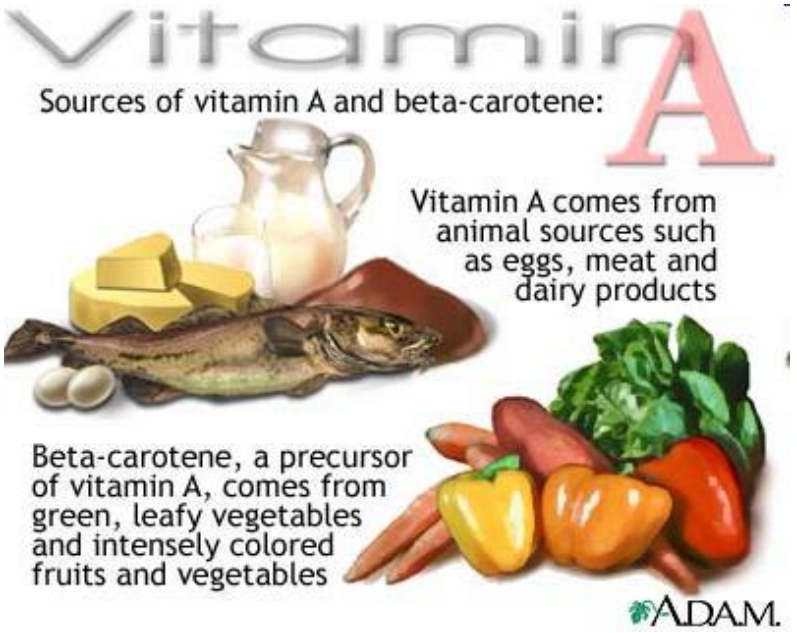
From animals

- cod liver oil
- meat
- egg
- milk
- dairy products

From plants

- carrot
- broccoli
- spinach
- papaya
- apricots

RDA: 900 micrograms for males; 700 micrograms for females



What does vitamin A do?

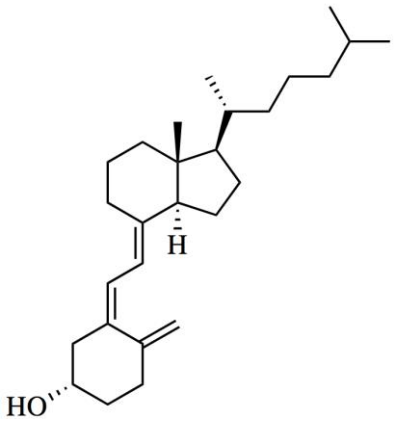
- Vision
  - Generates pigments for the retina
  - Maintains surface lining of eyes
- Bone growth
- Reproduction
- Cell division and differentiation
- Healthy Skin
- Regulate Immune System

Too much vitamin A...

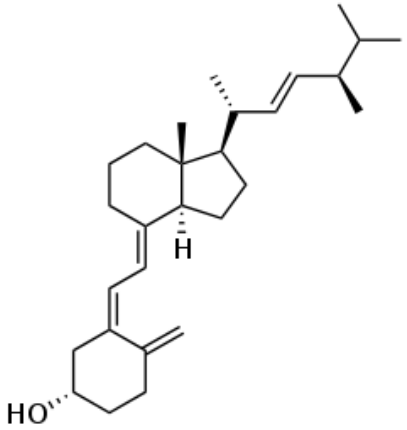
- May turn your skin orange
- (Carotenoids (from carrots) are non toxic - accumulation in tissues rich in lipids; the skin of babies overdosed with carrot juice may be orange).
- May cause fatigue, weakness, severe headache, blurred vision, hair loss and joint pain.
- Toxicity:
  - May cause severe liver or brain damage
  - Birth defects
  - Toxic dose: single dose of more than 200 mg; more than 40 mg per day

Examples: Lipid-soluble vitamins
Vitamin D

- Other Names
  - Calciferol, 1,25-dihydroxy vitamin D (calcitriol)
  - The animal version is vitamin D3 or cholecalciferol
  - The plant version is vitamin D2 or ergocalciferol
  - Body cholesterol is a precursor



Vitamin D3
(cholecalciferol)



Vitamin D2
(ergocalciferol)

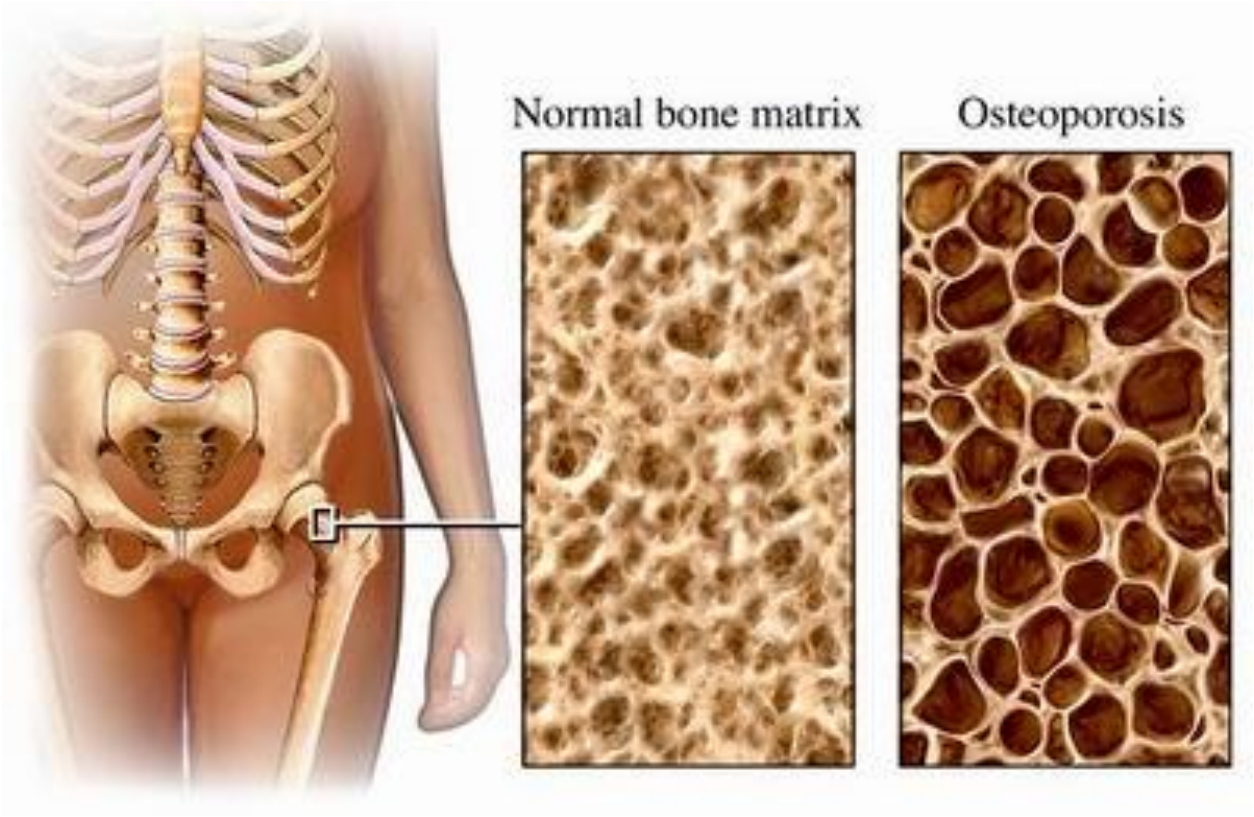
Vitamin D refers to a group of similar lipid-soluble molecules (major forms are D2 and D3, also D1, D4, D5).

Vitamin D – "The Sunshine Vitamin"

- Essential for building and maintaining bones and teeth
- Responsible for absorption and utilization of calcium
- Other health benefits:
  - May boost immune system
  - May also help decrease certain cancers
- RDA: 5 micrograms until age 50
    - 10 micrograms / day until 70; 15 mcg 70+

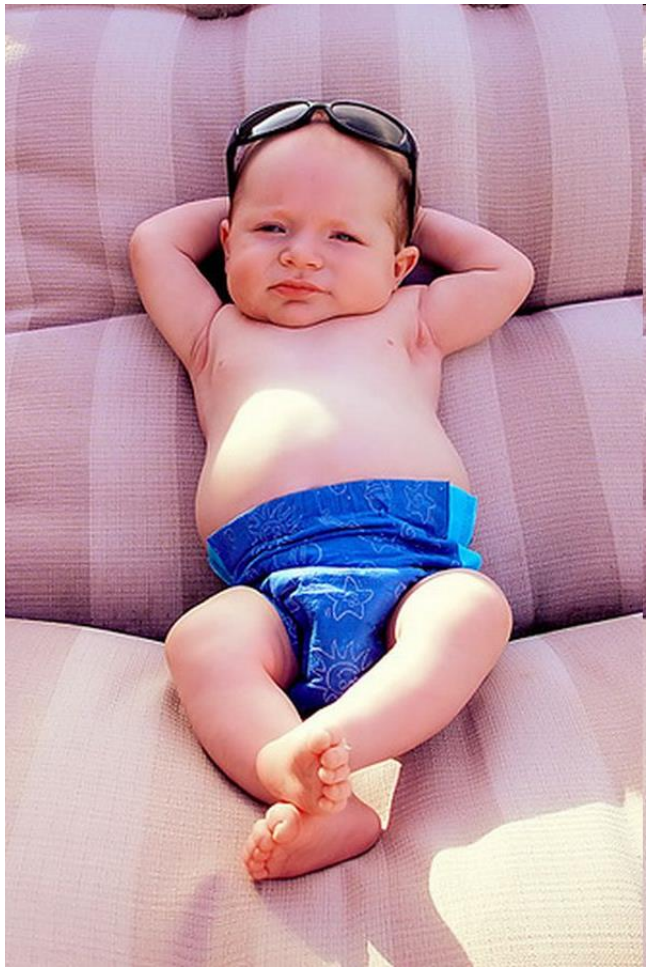
Vitamin D Deficiency

- May lead to osteomalacia and/or osteoporosis



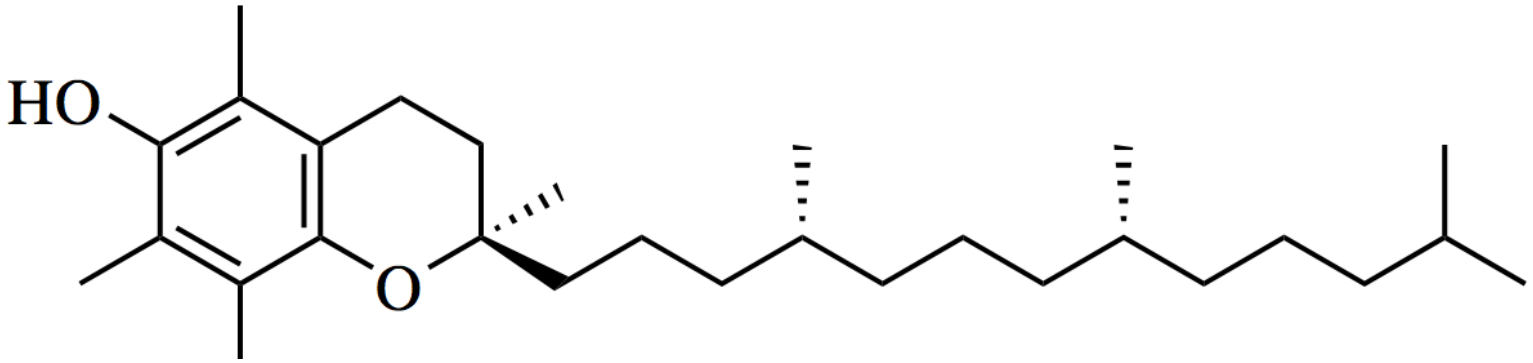
Sources of vitamin D

- In addition to sunbathing:
- various fish species (salmon, sardines and mackerel, tuna, catfish, eel), fish oil, cod liver
- eggs, beef liver, mushrooms



Vitamin E

- Vitamin E is a family of 8 α–, β–, γ–, δ– tocopherols and corresponding tocotrienol isomers.
- The highest biological activity has α-tocopherol.



It is essential, but not all roles are yet clear. Suggestions include neural membrane component, antioxidant. Important to red blood cells, muscles and other tissues

Obtained in diet, deficiency is rare.
Toxicity is rare: But Vitamin E acts as a blood thinner

Sources of vitamin E

- fortified cereals
- seeds and seed oils, like sunflower
- nuts and nut oils, like almonds and hazelnuts
- green leafy vegetables,
- broccoli
- cabbage
- celery

Vitamin E is found in corn, nuts, olives, green, leafy vegetables, vegetable oils and wheat germ

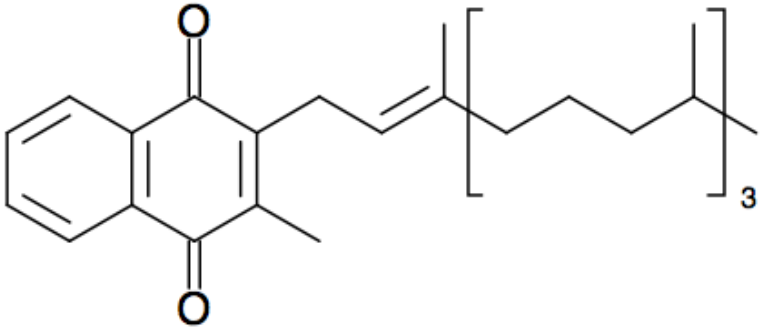
Vitamin E

Recommended Daily Allowances (RDA):

Children		
0-12 months	3-4 mg	9-12 IU
1-7 years	6-7 mg	15-21 IU
11-18	8 mg	24 IU
Males		
18+	10 mg	30 IU
Females		
18+	8 mg	24 IU
pregnant	12 mg	
lactating	11 mg	

Vitamin K

- **Vitamin K** is a group of lipophilic, hydrophobic vitamins. Refers to phylloquinone (vitamin K-1), and several structurally similar molecules.



phylloquinone

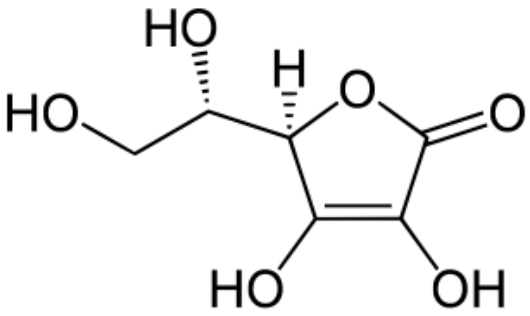
- Important for blood clotting
  - Also has a role for bone health
- Mostly made in the intestines
- Foods: Turnip greens, cauliflower, spinach, liver, broccoli, kale and cabbage
- Deficiency is rare. Toxicity risks.

Summary

- 13 different vitamins, each with its own roles
- Vitamins grouped into two major categories:
  - Fat-soluble (4 fat soluble; examples already shown)
    - Vitamin A
    - Vitamin D
    - Vitamin E
    - Vitamin K
  - Water-soluble (9 water soluble: 8 B vitamins & C)
    - Thiamin (B1)
    - Riboflavin (B2)
    - Niacin (B3)
    - Pantothenic acid (B5)
    - Vitamin B_6 (Pyridoxine)
    - Biotin (B7)
    - Folate or Folic Acid (B9)
    - Vitamin B_{12} (Cobalamine)
    - Vitamin C

One example water-soluble: **Vitamin C**

- Vitamin C (Ascorbic Acid) is a water-soluble vitamin.
- Almost all animals and plants synthesize their own vitamin C, but not man.
- Vitamin C was first isolated in 1928 and in 1932 it was proved to be the agent which prevents scurvy.
- Important to bone health, blood vessel health, cell structure and absorption of iron; Antioxidant
- Deficiency:
  - Rare
- Usually we consume too much vitamin C
- Cannot be stored in our body!
- Foods:
  - Melons, berries, tomatoes, potatoes, broccoli, fortified juices, kiwi, mangos, yellow peppers and citrus fruits



Should I get my vitamins from food or supplements/drinks?

- A diet high in fiber and relatively low in fat is the best way to meet daily nutritional needs.
- If you follow the “food pyramid” then you should meet the RDA (Recommended Dietary Allowances) for vitamins and nutrients easily, in particular in Japan.
- Supplements are best when accompanied by a well balanced diet.
- Supplements should and cannot replace a healthy diet.
- Food provides calories and energy that are required for daily activities
- Vitamin supplements do not provide energy or calories and cannot make up for bad habits like smoking or too little sleep.

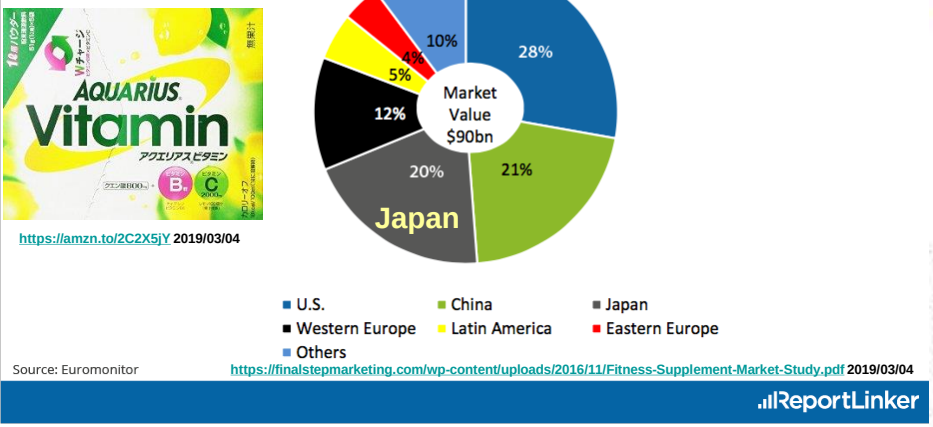
https://bit.ly/2UeS5Qs 2019/03/04

VS

https://bit.ly/2TycORU 2019/03/04

Vitamins are big business; some numbers

In 2014 every Japanese spent on average 82 US$ or 9000 ¥ per year on vitamin supplements, one of the highest in the world!



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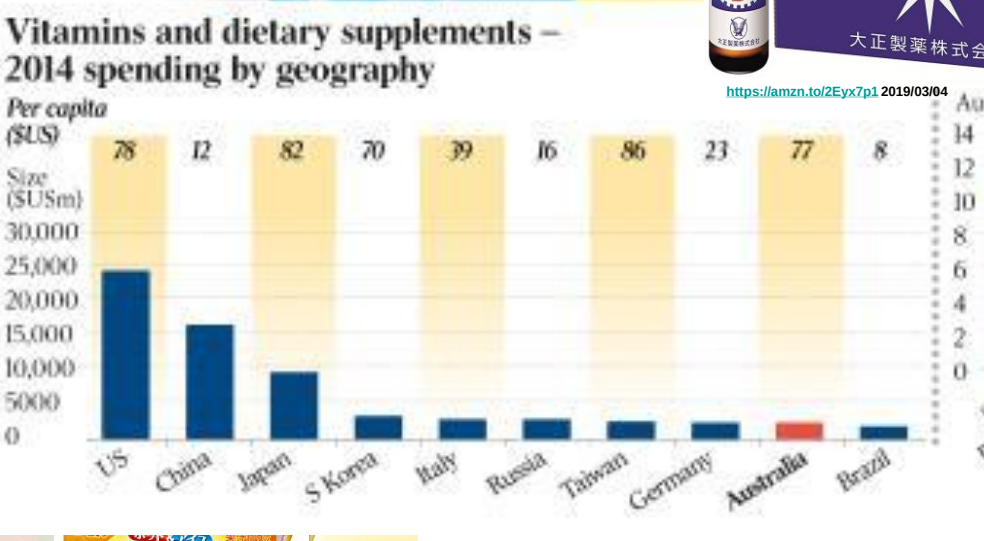

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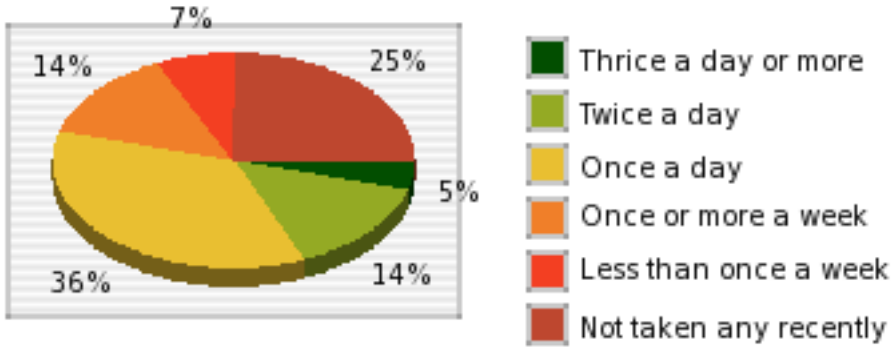
Vitamins are big business; some numbers

Polls in Japan:

69% of Japanese take supplements at least once a week or more often

what japan thinks.com

About how often do you take supplements?



Q1: Have you ever used supplements? (Sample size=1,500)

	All	Male N=750	Female N=750
Yes	75.1%	66.0%	84.1%
No	24.9%	34.0%	15.9%

Source: http://whatjapanthinks.com/2006/11/22/two-in-five-japanese-popping-vitamin-pills-daily/ 2019/03/04

Q2: Currently, which of these aspects do you particularly want to improve or maintain? (Sample size=1,500, multiple answer)

	All	Male N=750	Female N=750
Become younger	53.6%	46.5%	60.7%
Build strong body	48.3%	49.6%	47.1%
Lose weight	38.9%	32.4%	45.5%
Shiny, glossy skin	32.4%	12.8%	52.0%
Maintain body shape	29.1%	23.9%	34.4%
Blemish-free skin	28.9%	7.9%	49.9%
Clean pores	23.5%	5.5%	41.6%
Wrinkle-free skin	22.2%	5.6%	38.8%
Spot-free or smooth skin	19.0%	11.1%	26.9%
Improve resistance to allergies	12.5%	10.4%	14.5%
Improve period regularity, ED	8.5%	1.5%	15.2%
Cure dermatitis	5.3%	4.7%	6.0%
None of the above	7.9%	13.3%	2.5%

Source: http://whatjapanthinks.com/2006/11/22/two-in-five-japanese-popping-vitamin-pills-daily/ **2019/03/04**

Q4: Why are you using supplements? (Sample size=849)

To make up for insufficencies in diet	43.3%
Maintain health	42.4%
Relieve tired eyes	22.1%
Anti-aging	21.1%
Relieve work-related fatigue	19.6%
Beauty	17.1%
Improve blood condition	16.6%
Improve rough skin	16.5%
Lose weight	12.5%
Prevent colds	11.5%
Improve constitution	11.1%
Reduce cholesterol, neutral lipids	10.0%
Supplemental nourishment for muscle fatigue	10.0%

Source: http://whatjapanthinks.com/2006/11/22/two-in-five-japanese-popping-vitamin-pills-daily/ **2019/03/04**

Who does (may) need vitamin supplements?

- **People with certain nutritional deficiencies**
- **People with low energy intake – less than 1600 calories per day**
- **Vegans and those with atrophic gastritis need vitamin B_{12}**
- **People with lactose intolerance, milk allergies, or inadequate intake of dairy foods**
- **People in certain stages of the life cycle**
- **Infants may need iron and fluoride and certain vitamins**
- **Women of childbearing age may need folate**
- **Pregnant women need folate and iron**
- **Elderly need more vitamins B12 and D**
- **People with diseases, infections, or injuries, and those who have had surgery that affects nutrient digestion, absorption or metabolism**
- **People taking medications that interfere with the body's use of specific nutrients**

BUT: If you feel you belong to one or more of the above groups, better talk FIRST with your doctor!

There may be OTHER reasons for your problems that need medical attention!

Arguments AGAINST vitamin supplements?

- **Toxicity**
- **Life-threatening misinformation**
- **Unknown needs**
- **False sense of security**
- **Wrong belief that food supply and soil contain inadequate nutrients**
- **Wrong belief that supplements provide energy**
- **Wrong belief that supplements help lose weight**
- **Wrong belief that supplements enhance athletic performance or lean body mass without physical work or faster than work alone**
- **Wrong belief that supplements will help a person cope with stress, wrong diet or lack of sleep**
- **Wrong belief that supplements can prevent, treat or cure conditions**

Do we need vitamin supplements?

A recent New York Times article asked, "Should We Toss Our Vitamin Pills?"

Citations from this article:

"In an unusually direct opinion piece, the five authors say (in a medical journal) that for healthy Americans worried about chronic disease, there's no clear benefit to taking vitamin and mineral pills. And in some instances, they may even cause harm."

"The authors make an exception for supplemental vitamin D, which they say needs further research. Even so, widespread use of vitamin D pills "is not based on solid evidence that benefits outweigh harms," the authors wrote.

For other vitamins and supplements, "the case is closed."

Another citation:

"Dr. Fortmann, who also did not write or sign the editorial, suggested that those who buy vitamins may be "throwing their money away," adding: "Don't think it makes up for a bad diet, that you can eat a lot of fast food and then take a bunch of supplements. That's not a good idea.""