

# Fat Soluble Vitamins in Human Diet

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**ABSTRACT:** Most vitamins are water-soluble, meaning they dissolve in water. In contrast, fat-soluble vitamins are similar to oil and do not dissolve in water.

There are four fat-soluble vitamins :

- vitamin A
- vitamin D
- vitamin E
- vitamin K

**KEYWORDS:** vitamins, fat-soluble, A,D,E,K, dissolve, fat, water, effects, human, diet

## I. INTRODUCTION

Vitamin A

Vitamin A plays a key role in maintaining your vision. Without it, you would go blind.

Types

Vitamin A is not a single compound. Rather, it is a group of fat-soluble compounds collectively known as retinoids.[1,2]

The most common dietary form of vitamin A is retinol. Other forms — retinal and retinoic acid — are found in the body, but absent or rare in foods.

Vitamin A2 (3,4-dehydroretinal) is an alternative, less active form found in freshwater fish

Role and function of vitamin A

Vitamin A supports many critical aspects of your body function, including:

- Vision maintenance. Vitamin A is essential for maintaining the light-sensing cells in your eyes and for the formation of tear fluid

# International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

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Volume 5, Issue 8, August 2018

- Immune function. Vitamin A deficiency impairs your immune function, increasing susceptibility to infections
- Body growth. Vitamin A is necessary for cell growth in your body. Deficiency may slow or prevent growth in children
- Hair growth. It is also vital for hair growth. Deficiency leads to alopecia, or hair loss
- Reproductive function. Vitamin A maintains fertility and is vital for fetal development

## Dietary sources

Vitamin A is only found in animal-sourced foods. The main natural food sources are:

- liver
- fish liver oil
- butter

Vitamin A can also be derived from certain carotenoid antioxidants found in plants. They are collectively known as provitamin A. The most efficient of these is beta-carotene, which is abundant in many vegetables, such as carrots, kale, and spinach[3,4]

The table below shows the recommended daily allowance (RDA) for vitamin A. The RDA is the estimated amount of vitamin A that the vast majority (about 97.5%) of people need to meet their daily requirements. This table also shows the tolerable upper intake limit (UL), which is the maximum daily intake considered unlikely to cause adverse health effects

|          |             | RDA (mcg RAE) | UL (mcg RAE) |
|----------|-------------|---------------|--------------|
| Infants  | 0–6 months  | 400           | 600          |
|          | 7–12 months | 500           | 600          |
| Children | 1–3 years   | 300           | 600          |
|          | 4–8 years   | 400           | 900          |
|          | 9–13 years  | 600           | 1,700        |
| Women    | 14–18 years | 700           | 2,800        |
|          | 19–70 years | 700           | 3,000        |
| Men      | 14–18 years | 900           | 2,800        |
|          | 19–70 years | 900           | 3,000        |

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Vitamin A deficiency is rare in developed countries.

However, vegans may be at risk since preformed vitamin A is only found in animal-sourced foods.

Although provitamin A is abundant in many fruits and vegetables, it is not always efficiently converted into retinol, the active form of vitamin A. The efficiency of this conversion depends on your genetics

Deficiency is also widespread in some developing countries where food variety is limited. It is common in populations whose diet is dominated by refined rice, white potatoes, or cassava and lacking in meat, fat, and vegetables.[5,6]

A common symptom of early deficiency includes night blindness. As it progresses, it may lead to more serious conditions, such as:

- Dry eyes. Severe deficiency may cause xerophthalmia, a condition characterized by dry eyes caused by reduced tear fluid formation
- Blindness. Serious vitamin A deficiency may lead to total blindness. In fact, it is among the most common preventable causes of blindness in the world
- Hair loss. If you are vitamin A deficient, you may start to lose your hair
- Skin problems. Deficiency leads to a skin condition known as hyperkeratosis, or goose flesh
- Poor immune function. Poor vitamin A status or deficiency makes you prone to infections

Overdosing on vitamin A leads to an adverse condition known as hypervitaminosis A. It's rare but may have serious health effects.

Its main causes are excessive doses of vitamin A from supplements, liver, or fish liver oil. In contrast, a high intake of provitamin A does not cause hypervitaminosis.[7,8]

The main symptoms and consequences of toxicity include:

- fatigue
- headache
- irritability
- stomach pain
- joint pain
- lack of appetite
- vomiting
- blurred vision
- skin problems

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- inflammation in the mouth and eyes

It may also lead to:

- liver damage
- bone loss
- hair loss

At extremely high doses, vitamin A can be fatal

Healthcare professional advise against exceeding the upper limit for intake, which is 3,000 mcg of preformed vitamin A per day for adults.

Higher amounts may cause acute hypervitaminosis A in adults. Children can experience harmful effects at much lower amounts [9,10]

Individual tolerance varies considerably. Children and people with liver diseases like cirrhosis and hepatitis are at an increased risk and need to take extra care.

Pregnant women should also be especially careful, since high doses of vitamin A may harm the fetus

## **II. DISCUSSION**

Vitamin D is a collective term used to describe a few related fat-soluble compounds.

Also known as calciferol, vitamin D comes in two main dietary forms:

- Vitamin D2 (ergocalciferol). This form is found in mushrooms and some plants.
- Vitamin D3 (cholecalciferol). This form is found in animal-sourced foods, such as eggs and fish oil, and produced when your skin is exposed to sunlight.

Vitamin D has numerous roles and functions, but only a few are well researched. These include the following:

- Bone maintenance. Vitamin D regulates the circulating levels of calcium and phosphorus, which are the most important minerals for bone growth and maintenance. It promotes the absorption of these minerals from your diet.
- Immune system regulation. It also regulates and strengthens your immune system function [11,12]

Once absorbed into the bloodstream, your liver and kidneys change calciferol into calcitriol, which is the biologically active form of vitamin D. It can also be stored for later use in the form of calcidiol.

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Vitamin D3 is more efficiently converted into calcitriol than vitamin D2 .

Your body can produce all the vitamin D it needs as long as you regularly expose large parts of your skin to sunlight

However, many people spend little time in the sun or do so fully clothed. Justifiably, others cover their skin with sunscreen to prevent sunburns. While sunscreen use is highly recommended, it reduces the amount of vitamin D your skin produces.

As a result, people generally need to rely on their diets to get enough vitamin D.

Few foods naturally contain vitamin D. [13,14]The best dietary sources are fatty fish and fish oil, but mushrooms that have been exposed to ultraviolet light may also contain significant amounts.

Since no RDA has been established for infants, the values marked with an asterisk are the adequate intake (AI). The AI is similar to the RDA, but it's based on weaker evidence.

| Age Group   | RDA (IU / mcg) | UL (IU / mcg) |
|-------------|----------------|---------------|
| 0–6 months  | 400 / 10*      | 1,000 / 25    |
| 7–12 months | 400 / 10*      | 1,500 / 38    |
| 1–3 years   | 600 / 15       | 2,500 / 63    |
| 4–8 years   | 600 / 15       | 3,000 / 75    |
| 9–70 years  | 600 / 15       | 4,000 / 1,000 |
| 70+ years   | 800 / 20       | 4,000 / 1,000 |

Severe vitamin D deficiency is rare, but mild forms of deficiency or insufficiency are common among people who are hospitalized as well as older adults.

Risk factors of deficiency are:

- darker skin tone
- older age
- obesity
- low sun exposure
- diseases that impair fat absorption[15,16]

The most well-known consequences of vitamin D deficiency include soft bones, weak muscles, and an increased risk of bone fractures. This condition is called osteomalacia in adults and rickets in children . Vitamin D deficiency is also associated with poor immune function, increased susceptibility to infections, and autoimmune diseases .Other signs of

deficiency or insufficiency may include fatigue, depression, hair loss, and impaired wound healing. Observational studies have also linked low vitamin D levels or deficiency with an increased risk of dying from cancer and an elevated risk of heart attacks [17,18]

### III. RESULTS

As a powerful antioxidant, vitamin E protects your cells against premature aging and damage by free radicals.

#### Types

Vitamin E is a family of eight structurally similar antioxidants that are divided into two groups:

- Tocopherols: alpha-tocopherol, beta-tocopherol, gamma-tocopherol, and delta-tocopherol
- Tocotrienols: alpha-tocotrienol, beta-tocotrienol, gamma-tocotrienol, and delta-tocotrienol

Alpha-tocopherol is the most common form of vitamin E. It makes up around 90% of the vitamin E in the blood. Vitamin E's main role is to act as an antioxidant, preventing oxidative stress and protecting fatty acids in your cell membranes from free radicals. These antioxidant properties are enhanced by other nutrients, such as vitamin C, vitamin B3, and selenium. In high amounts, vitamin E also acts as a blood thinner, reducing the blood's ability to clot

|             |             | RDA (mg) | UL (mg)   |
|-------------|-------------|----------|-----------|
| Infants     | 0–6 months  | 4*       | Not known |
|             | 7–12 months | 5*       | Not known |
| Children    | 1–3 years   | 6        | 200       |
|             | 4–8 years   | 7        | 300       |
|             | 9–13 years  | 11       | 600       |
| Adolescents | 14–18 years | 15       | 800       |
| Adults      | 19–50 years | 15       | 1,000     |
|             | 51+ years   | 12       | 1,000     |

Vitamin E deficiency is uncommon and is never detected in people who are otherwise healthy.

It happens most often when diseases that impair the absorption of fat or vitamin E from food, such as cystic fibrosis and liver disease, are present.

Symptoms of vitamin E deficiency include:

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- muscle weakness
- walking difficulties
- tremors
- vision problems
- weakened immune function
- numbness[19,20]

Severe, long-term deficiency may lead to anemia, heart disease, serious neurological problems, blindness, dementia, poor reflexes, and the inability to fully control body movements

Overdosing on vitamin E is difficult when it is obtained from natural dietary sources. Cases of toxicity have only been reported after people have taken very high doses of supplements.

Yet, compared to vitamins A and D, overdosing on vitamin E appears to have a less harmful effect, but it still requires medical intervention.

It may have blood-thinning effects, counteracting the effects of vitamin K and causing excessive bleeding. Thus, people who take blood-thinning medications should avoid taking large doses of vitamin E

#### **IV. CONCLUSIONS**

Vitamin K is actually a group of fat-soluble compounds divided into two main groups:

- Vitamin K1 (phylloquinone). Found in plant-sourced foods, phylloquinone is the main form of vitamin K in the diet
- Vitamin K2 (menaquinone). This variety of vitamin K is found in animal-sourced foods and fermented soy products, like natto. Vitamin K2 is also produced by gut bacteria in the colon

Additionally, there are at least three synthetic forms of vitamin K. These are known as vitamin K3 (menadione), vitamin K4 (menadiol diacetate), and vitamin K5. Vitamin K plays an essential role in blood clotting. In fact, the “K” stands for “koagulation,” the Danish word for coagulation, which means clotting. But vitamin K has other functions as well, including supporting bone health and helping prevent the calcification of blood vessels, potentially reducing the risk of heart disease. The best dietary sources of vitamin K1 (phylloquinone) are leafy green vegetables, while vitamin K2 (menaquinone) is mainly found in animal-sourced foods and fermented soy products.[21]

|             |             | AI (mcg) |
|-------------|-------------|----------|
| Infants     | 0–6 months  | 2        |
|             | 7–12 months | 2.5      |
| Children    | 1–3 years   | 30       |
|             | 4–8 years   | 55       |
|             | 9–13 years  | 60       |
| Adolescents | 14–18 years | 75       |
| Women       | 18+ years   | 90       |
| Men         | 18+ years   | 120      |

Vitamin K is a group of fat-soluble compounds divided into vitamin K1 (phylloquinone) and vitamin K2 (menaquinone).

Vitamin K1 is mainly found in leafy green vegetables, while vitamin K2 comes from animal-sourced foods, such as liver, butter, and egg yolks.

Small amounts are also produced by gut bacteria in the colon.

Deficiency impairs the blood's ability to clot, causing a risk of excessive bleeding.

There is limited evidence on the health benefits of supplements among people who are not deficient. However, a few controlled studies suggest that vitamin K supplements benefit bone and heart health.[22]

## REFERENCES

1. Jones, Daniel (2011). Roach, Peter; Setter, Jane; Esling, John (eds.). Cambridge English Pronouncing Dictionary (18th ed.). Cambridge University Press. ISBN 978-0-521-15255-6.
2. ^ Maton, Anthea; Hopkins, Jean; McLaughlin, Charles William; Johnson, Susan; Warner, Maryanna Quon; LaHart, David; Wright, Jill D. (1993). Human Biology and Health. Englewood Cliffs, New Jersey, USA: Prentice Hall. ISBN 978-0-13-981176-0. OCLC 32308337.
3. ^ Publishing, Harvard Health (9 June 2009). "Listing of vitamins". Harvard Health. Retrieved 12 May 2016.
4. ^ "Vitamins and Minerals". National Institute on Aging. Retrieved 12 May 2016.
5. ^ Vitamin and mineral requirements in human nutrition 2nd Edition. World Health Organization and Food and Agriculture Organization of the United Nations. 2004. pp. 340–341. ISBN 9241546123. Archived from the original on 12 December 2012.
6. ^ "EUR-Lex - 32006R1925 - EN - EUR-Lex". eur-lex.europa.eu.
7. ^ Bender DA (2003). Nutritional biochemistry of the vitamins. Cambridge, U.K.: Cambridge University Press. ISBN 978-0-521-80388-5.
8. ^ Price C (2015). Vitamania: Our obsessive quest for nutritional perfection. Penguin Press. ISBN 978-1594205040.



9. ^ "Food Fortification Initiative". Food Fortification Initiative, Enhancing Grains for Better Lives. Archived from the original on 4 April 2017. Retrieved 18 August 2016.
10. ^ Wilson RD, Wilson RD, Audibert F, Brock JA, Carroll J, Cartier L, et al. (June 2015). "Pre-conception Folic Acid and Multivitamin Supplementation for the Primary and Secondary Prevention of Neural Tube Defects and Other Folic Acid-Sensitive Congenital Anomalies". *Journal of Obstetrics and Gynaecology Canada*. 37 (6): 534–52. doi:10.1016/s1701-2163(15)30230-9. PMID 26334606.
11. ^ Dietary Reference Intakes (DRIs) Archived 11 September 2016 at the Wayback Machine Food and Nutrition Board, Institute of Medicine, National Academies
12. ^ "Vitamin A: Fact Sheet for Health Professionals". National Institute of Health: Office of Dietary Supplements. 5 June 2013. Archived from the original on 23 September 2009. Retrieved 3 August 2013.
13. ^ "Thiamin, vitamin B1: MedlinePlus Supplements". U.S. Department of Health and Human Services, National Institutes of Health.
14. ^ Hardman, J.G.; et al., eds. (2001). Goodman and Gilman's Pharmacological Basis of Therapeutics (10th ed.). p. 992. ISBN 978-0071354691.
15. ^ "Pantothenic acid, dexpantenol: MedlinePlus Supplements". MedlinePlus. Retrieved 5 October 2009.
16. ^ Vitamin and Mineral Supplement Fact Sheets Vitamin B6 Archived 23 September 2009 at the Wayback Machine. Dietary-supplements.info.nih.gov (15 September 2011). Retrieved on 2013-08-03.
17. ^ Institute of Medicine (1998). "Vitamin B<sub>6</sub>". *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline*. Washington, DC: The National Academies Press. pp. 150–195. doi:10.17226/6015. ISBN 978-0-309-06554-2. LCCN 00028380. OCLC 475527045. PMID 23193625.
18. ^ Vitamin and Mineral Supplement Fact Sheets Vitamin B12 Archived 23 September 2009 at the Wayback Machine. Dietary-supplements.info.nih.gov (24 June 2011). Retrieved on 2013-08-03.
19. ^ Vitamins and minerals (3 March 2017). Retrieved on 2 June 2016.
20. ^ The Merck Manual: Nutritional Disorders: Vitamin Introduction Please select specific vitamins from the list at the top of the page.
21. ^ Gaby AR (2005). "Does vitamin E cause congestive heart failure? (Literature Review & Commentary)". *Townsend Letter for Doctors and Patients*. Archived from the original on 10 September 2016.
22. ^ Higdon, Jane (2011) Vitamin E recommendations at Linus Pauling Institute's Micronutrient Information Center