

NUTRIENTS

Vitamins: Vitamin A

What is it?

Vitamin A is a family of fat-soluble vitamins that is found in foods in a variety of forms.

There are two main dietary sources of vitamin A:-

- Retinoids (preformed vitamin A found in foods of animal origin), and
- Carotenoids (found in foods of plant origin in the form of common plant pigments - such as yellow-orange pigment of carrots - and converted to vitamin A)

Retinol, one of the most active and usable, forms of vitamin A is often called preformed vitamin A. It can be converted to retinal and retinoic acid, other active forms of the vitamin A family.

Carotenoids are also called provitamin A because parts can often be turned into vitamin A. The most potent form of provitamin A is beta-carotene.

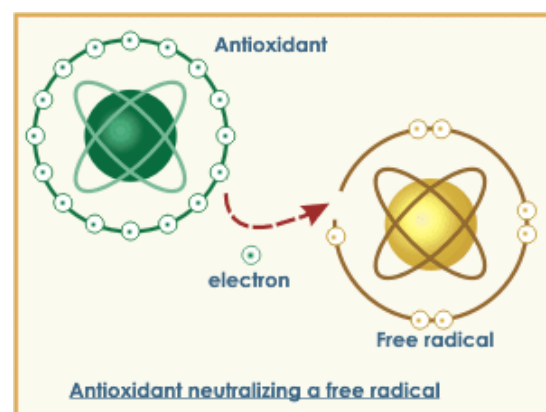
Functions - what does it do?

Vision. Vitamin A plays an important role in light-dark and colour vision. One form of vitamin A, retinol, is required to start the chemical process that signals the brain that light is striking the eye, which allows the eye to adjust from bright to dim light.

Epithelial cells. Vitamin A maintains the health of epithelial cells that line internal and external surfaces of the lungs, intestines, stomach, vagina, urinary tract and bladder, eyes and skin. These cells act as important barriers to bacteria. Certain epithelial cells secrete mucous to keep the skin, eyes and other mucous membranes moist.

Growth and development. Vitamin A is necessary for cell growth and cell differentiation - the process by which a cell changes its structure and develops specific functions. It plays important roles in reproduction, bone growth and tooth development.

Antioxidant. Some carotenoids, in addition to serving as a source of vitamin A, have been shown to function as antioxidants. Antioxidants protect your cells against the effects of free radicals, which are potentially damaging compounds produced as by-products of metabolism, as well as through exposure to toxins and pollutants (e.g. smoking). Free radicals can cause cell damage that may contribute to the development of cardiovascular disease and cancers. Thus Vitamin A and related nutrients may collectively be important in protecting against conditions related to oxidative stress, such as aging, air pollution, arthritis, cancer, cardiovascular disease, cataracts, diabetes mellitus and infection. However, this role has not been consistently demonstrated in humans.



Requirements - How much do we need?

Life-Stage (years)	Recommended Dietary Allowance* (µg/day RAE#)	
	Males	Females
0 - 0.5 (0 - 6 months)	400*	400*
0.5 - 1 (7 - 12 months)	500 ^a	500*
1 - 3	300	300
4 - 8	400	400
9 - 13	600	600
14 - 18	900	700
Ages 19+	900	700
Life-Stage (years)	Pregnancy	Lactation
18 and younger	750	1200
19 - 30	770	1300
Ages 31+	770	1300

*The Recommended Dietary Allowances (RDA) for vitamin A are listed as Retinol Activity Equivalents (RAE) to account for the different activities of retinol and provitamin A carotenoids. Sometimes RDAs are also listed in International Units (IU) because food and some supplement labels list vitamin A content in International Units (1 RAE in micrograms = 3.3 IU).

Retinol Activity Equivalent (RAE)	Commonly Used Units
1 µg RAE =	<ul style="list-style-type: none"> - 1 RE of retinol (vitamin A) - 1 µg retinol (vitamin A) - 2 µg β-carotene in oil - 12 µg β-carotene in mixed food - 24 µg other provitamin A carotenoids in mixed foods

*The Recommended Dietary Allowance (RDA) is the average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in each life-stage and gender group.

^aAdequate Intakes (AI) are used as no RDA is established. The AI is a recommended daily intake level based on observed or experimentally determined approximations of nutrient intake by a group of healthy people who are assumed to be maintaining an adequate nutritional state.

Sources - Where is it found?

Food Groups	Food Sources	Nutrient Density		
		High	Medium	Low
Vegetables	Carrots, Broccoli, Spinach, Squash, Sweet potatoes			
Fruit	Peaches, Apricots, Cantaloupes, Mangoes, Papaya			
Milk, yoghurt and cheese	Cheese, Fortified milk			
Meat, poultry, fish, dry beans, eggs, and nuts	Liver, Eggs			
Fats, oils, and sweets	Butter, Margarine			
Bread, cereals, rice and pasta	Fortified breakfast cereals			

Deficiency - When you have too little

Night blindness (Nyctalopia). With insufficient dietary intake of vitamin A, the eye cannot adjust to dim light. This condition is known as night blindness. Night blindness can be alleviated by a high oral dose of vitamin A.

Xerophthalmia. If the vitamin A deficiency and night blindness is not treated, the cells that line the cornea (the clear window) of the eye stop producing lubricating mucous. Instead, the cells produce a protein, called keratin, which causes the eye to dry, harden and crack, allowing bacteria to infect it. The infection can spread over the whole eye causing blindness. This process is called xerophthalmia, which means "dry eye".

NOTE: In South Africa, eye disease caused by vitamin A deficiency is not commonly seen. The effects of vitamin A deficiency on growth and infection are far more significant.

Growth faltering. Vitamin A deficiency is associated with reduced appetite, weight loss and failure to grow adequately. Children who are malnourished have a lower resistance to infection and they are more likely to fall ill than well-nourished children. During serious infections such as measles and diarrhoea, children lose a lot of weight.

Infections. Vitamin A deficiency also causes insufficient mucous production from the cells in the intestines and lungs increasing the risk of infection. Insufficient mucous production in the skin causes very dry, rough skin.

Vitamin A deficiency in children is associated with reduced appetite, stunted growth, respiratory diseases and increased severity of infectious diseases, particularly diarrhoea and measles, which dramatically increase their risk of death.

Toxicity - When you have too much

An intake of 5 times the RDA for vitamin A taken for a prolonged period can be associated with adverse effects, especially during pregnancy and in the elderly. There are three major adverse effects of vitamin A toxicity:

- severe birth defects,
- liver damage, and
- reduced bone density (solidness) that may result in osteoporosis

Other possible adverse effects from toxicity can result in dry, itchy skin, headache, fatigue, hair loss, loss of appetite, weight loss, high blood calcium levels and vomiting.

Life-Stage (years)	Upper Limit+ (µg/day RAE)	
	Males	Females
0 - 0.5 (0 - 6 months)	600	600
0.5 - 1 (7 - 12 months)	600	600
1 - 3	600	600
4 - 8	900	900
9 - 13	1700	1700
14 - 18	2800	2800
Ages 19+	3000	3000
Life-Stage (years)	Pregnancy	Lactation
18 and younger	2800	2800
19 - 30	3000	3000
Ages 31+	3000	3000

1 Retinol Activity Equivalent (RAE) in µg = 3.3 International Units (IU)

+Upper Limits (UL) = The maximum level of daily nutrient intake that is likely to pose no risk of adverse effects. Unless otherwise specified, the UL represents total intake from food, water, and supplements.

ND = Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

For further, personalized and more detailed information, please contact a dietitian registered with the Health Professions Council of South Africa. References from the scientific literature used to compile this document are available on request.

Human Nutrition | Menslike Voeding

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