



CONVERSION FACTORS FOR VITAMIN A AND CAROTENOIDS

Vitamin A and carotenoids can be quantified in several different units, but it is preferable to use the International System of Units (SI) such as μmol :

SI Units

$1\mu\text{mol}$ retinol (vitamin A)

$1\mu\text{mol}$ β -carotene

Commonly Used Units

= 286 μg retinol
(vitamin A)

= 537 μg β -carotene

Supplements, food, and animal feed:

0.00349 μmol retinol
(vitamin A)

= 1 μg retinol (vitamin A)
1.15 μg retinyl acetate
1.83 μg retinyl palmitate
3.33 IU (1 IU = 0.3 μg)

For example, vitamin A in an oil supplement:

209 μmol retinol
(vitamin A)

= 200,000 IU
60,000 μg retinol
(vitamin A)

Retinol concentrations in:

Serum: 1 $\mu\text{mol/L}$ = 28.6 $\mu\text{g/dL}$

Liver: 1 $\mu\text{mol/g}$ = 286 $\mu\text{g/g}$

Milk: 1 $\mu\text{mol/L}$ = 28.6 $\mu\text{g/dL}$

Fat: 1 $\mu\text{mol/g}$ = 286 $\mu\text{g/g}$

Unit conversion for commonly used cutoff values for serum retinol (vitamin A) concentration:

0.35 $\mu\text{mol/L}$ = 10 $\mu\text{g/dL}$

0.70 $\mu\text{mol/L}$ = 20 $\mu\text{g/dL}$

1.05 $\mu\text{mol/L}$ = 30 $\mu\text{g/dL}$

INTERNATIONAL VITAMIN A CONSULTATIVE GROUP (IVACG)

RETINOL ACTIVITY EQUIVALENT

The term “retinol activity equivalent” (RAE) was introduced by the U.S. Institute of Medicine (IOM)¹ to replace “retinol equivalent” (RE) used by FAO/WHO² to take into account new research on the vitamin A activity (bioefficacy) of carotenoids. The IOM deemed carotenoid bioefficacy in mixed foods eaten by healthy people in developed countries to be half the required amount set by FAO/WHO. Bioefficacy may, in fact, be even lower in populations in developing countries.³

References:

1. U.S. Institute of Medicine. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, DC: National Academy Press, 2000.
2. FAO/WHO Joint Expert Consultation. (1988) Requirements of vitamin A, iron, folate and vitamin B12. FAO Food and Nutrition Series no. 23. Rome: FAO.
3. West CE, Eilander A. Consequences of revised estimates of carotenoid bioefficacy for the dietary control of vitamin A deficiency in developing countries. J Nutr 2001 (in press).

Retinol Activity Equivalent (RAE)

1 µg RAE =

Commonly Used Units

- 1 RE of retinol (vitamin A)
- 1 µg retinol (vitamin A)
- 2 µg β-carotene in oil
- 12 µg β-carotene in mixed foods
- 24 µg other provitamin A carotenoids in mixed foods

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