

# SuperNutrition's Fact vs Fiction

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## WHY FACT VS FICTION?

We are frequently asked why we use or do not use certain ingredients or forms of nutrients in our multi-vitamin formulas.

Fact Vs Fiction provides information on how we choose specific forms of nutrients.

Scientific references are cited and text from abstracts is included to provide research details.

We evaluate nutritional ingredients by the following criteria:

- 1) Is it natural and normal to the human body?
- 2) Has it had a long history of safe use in humans?
- 3) Is it supported by science and/or traditional herbal wisdom?
- 4) Is it nutritionally effective?
- 5) Is it cost-effective for our customers?
- 6) Is it concentrated enough that we can provide optimal levels to our customers in a reasonable number of tablets?

We have no vested interest in any form of nutrient. Our selections are based on what is best for our customers' health and their pocketbook.

## The Truth About Vitamin A (Retinol) and Beta-Carotene

**Fiction:** Vitamin A (retinol) is toxic and should not be supplemented.

**Fact:** Vitamin A (retinol) is a vitamin and is necessary for life itself. There has never been a report of a toxic dose of Vitamin A from a daily multi-vitamin. The lowest even slightly toxic Vitamin A overdose level that has been reported was more than seven times the RDA.

**Fiction:** Supplemental Vitamin A is not necessary because beta-carotene converts to Vitamin A in the body.

**Fact:** Scientific studies indicate that millions of people do not convert beta-carotene into Vitamin well enough to substitute for Vitamin A.

**Fiction:** Pregnant women should avoid Vitamin A (either as retinol palmitate or acetate) because they cause birth defects.

**Fact:** US Government records show no birth defects ever being caused by the amounts of Vitamin A in multi-vitamin (retinol palmitate or retinol acetate).

## INSIDE

- The Six Types of People Most At Risk for Vitamin A Deficiency
- Vitamin A, Pregnancy And Healthy Baby's Bones

## Vitamin A (Retinol) And Beta-Carotene

We have been asked by many of our customers to clarify current questions about supplemental Vitamin A (also called retinol) and beta-carotene. The most common are:

1. Is the retinol form of Vitamin A natural?
2. Is supplemental Vitamin A (retinol) toxic?
3. Are the types of Vitamin A known as retinol palmitate and retinol acetate safe?
4. Doesn't supplemented Vitamin A (retinol) cause birth defects?
5. Doesn't beta-carotene substitute for Vitamin A (retinol) by converting into Vitamin A in the body as needed?
6. Should we even supplement Vitamin A (retinol)?
7. Why does SuperNutrition put Vitamin A (retinol) in our daily vitamin formulas?

## Vitamin A (Retinol): Is It Natural? Is It Toxic?

Vitamin A (retinol) is a vitamin and is necessary for life and overall health. It is found in nature as pro-vitamin A in plants and as pre-formed Vitamin A in animal products. Pro-vitamin A is seen as the red, orange, and yellow colored carotenes in fruits and vegetables. The most abundant and well-known carotene is beta-carotene. Pre-formed Vitamin A consists of various forms of retinoic acid, including retinol. The word retinol is commonly used by scientists when referring to Vitamin A. Retinol and other retinoids, such as cis-retinoic acid, are metabolized in the body and stored in the liver primarily as retinyl palmitate.<sup>1</sup> Vitamin A in the blood stream is called serum retinol and is measured in "retinol equivalents".

According to the US Government's nutritional advisor, the National Academy of Sciences' Institute of Medicine, the Vitamin A (retinol) found in dietary supplements is known to be safe and completely non-toxic at the recommended daily allowance (RDA) levels of 2333 IU for women and 3000 IU for men. The Institute of Medicine has stated that Vitamin A is safe below the Tolerable Upper Limit, which is 10,000 IU.<sup>2</sup> (Tolerable Upper Limits for nutrients are safe levels well below the lowest dosage levels in any reports of even minor adverse effects.)

## Vitamin A And Bone Density: Concerns About The Accuracy Of The New Recommendations

Recently, new scientific studies have indicated that the best doses of Vitamin A for optimal bone density for some people are lower than the U.S. Government's Tolerable Upper Limit. The newly estimated range of optimal total Vitamin A intake for best bone density for those people is estimated to be between about 2000 IU and 2800 IU per day.<sup>3</sup> Further studies are needed to clarify exactly who this affects. This dosage range, which is close to the RDA dosage range, is made up of the total Vitamin A (retinol) intake from both food and supplements combined.

Note: There are some important concerns about the accuracy of the new recommendations. These concerns arise because the authors of the studies reported on known inaccuracies and possible inaccuracies in these new studies. One major concern they reported is related to the calculation of the total Vitamin A intake itself. This concern arises because Vitamin A intake was self-reported by the participants themselves, using food questionnaires and food diaries. It is well-known that food questionnaires and food diaries contain many errors with inaccuracies that can be off by from 20% to as great as

400%.<sup>58</sup> These inaccuracies occur in spite of statistical and other techniques used to attempt to reduce errors.

The authors of these new scientific studies on Vitamin A dosage go on to warn that other factors could cause errors, such as, but not limited to, “random error”, poor reporting of personal history by study participants, “long intervals between measurements,” and “unidentified confounders” which confound (confuse) the results. Furthermore, there is a concern about the probable inaccuracy of the beta-carotene-conversion-to-Vitamin A ratio used to calculate Vitamin A activity in the body from beta-carotene intake. When all is considered, these probable errors should create questions about the narrow range of Vitamin A intake given as recommendations for everyone when they may apply only to a small part of the population. The rest of us may need better information for optimal bone health.

For more details, see Fact vs Fiction #8, “The Truth About Vitamin A and Bone Density.”

Although Vitamin A intake below the 10,000 IU Tolerable Upper Limit has never been shown to cause even slight toxicity or any birth defects, these new studies, even with their probable errors, indicate that Vitamin A’s variable effects on bone density should be considered.

## **Are Retinol Palmitate And Acetate Natural And Safe?**

Vitamin A palmitate is also called retinol palmitate. Vitamin A acetate is also called retinol acetate.

Vitamin A palmitate (retinol palmitate) and Vitamin A acetate (retinol acetate) have been investigated in thousands of published peer-reviewed studies over dozens of years. They have each been shown to be safe, totally non-toxic and highly beneficial not only at RDA levels but also at levels up to the Tolerable Upper Limit of 10,000 IU.

Although we do not recommend taking higher doses of Vitamin A without medical monitoring, studies have shown that Vitamin A (retinol) palmitate and Vitamin A acetate can be non-toxic at doses considerably higher than RDA levels. For example, one study with 292 adults found that Vitamin A palmitate supplements did not produce toxic effects at a dose of 25,000 IU per day.<sup>5</sup> Therapeutic individual doses of Vitamin A palmitate as high as 200,000 IU have been safely administered to children who suffered from night blindness.<sup>6,7,8</sup> This is acknowledged as a standard-of-care therapy that is recommended by the World Health Organization.<sup>9</sup>

In one lung cancer study, Vitamin A palmitate supplements were therapeutically administered at 300,000 IU per day for twelve months and noted to be a “*well-tolerated and safe treatment.*”<sup>10</sup>

The Institute of Medicine stated in 2001 that Vitamin A has been shown to have “*no observed adverse effects*” at doses up to 21,000 IU per day.<sup>2</sup> This is more than seven times greater than the new RDA for Vitamin A.

At RDA levels or at Tolerable Upper Limit levels, neither Vitamin A palmitate nor Vitamin A acetate has ever been shown to be toxic in any way. Nor can we find any scientific evidence that there is another form of Vitamin A superior to either Vitamin A palmitate or Vitamin A acetate.

## **Safety And Necessity Of Vitamin A (Retinol) During Pregnancy**

As an essential nutrient, Vitamin A (retinol) is required for the health of the mother and her baby during pregnancy and after.<sup>11</sup> Total daily Vitamin A intake below the RDA of 2333 IU during

pregnancy can result in health complications for the newborn, including blindness or problems with baby's vision,<sup>6,7,8</sup> stunted growth and compromised bone growth,<sup>12</sup> depressed immune function, increased potential for neonatal infections, such as diarrhea, measles and respiratory infections like pneumonia, and increased infant morbidity and mortality.<sup>11</sup>

A study of 22,748 women indicated that 10,000 IU was the threshold dose above which there could be a very slight potential for birth defects.<sup>13</sup> This 10,000 IU total daily intake is the amount that the American Pediatric Society says is the safe upper limit for pregnant women.<sup>14</sup> Below this intake, no association with increased birth defects has been seen. However, a 1989 State of California environmental law recommended an even lower upper daily intake of 8000 IU for pregnant women.<sup>15</sup>

Another study with pregnant women questioned the earlier study's safe daily intake of 10,000 IU as being too conservative and calculated that Vitamin A intake up to 30,000 IU per day appeared to be safe.<sup>16</sup> Yet another study also indicated that 30,000 IU appeared to be safe.<sup>17</sup>

Prenatal multi-vitamin formulas typically contain less Vitamin A than the 10,000 IU Tolerable Upper Limit. Most contain less than the 8,000 IU recommended by the State of California. While Vitamin A above 10,000 IU may be associated with birth defects, daily intake that is below the RDA of 2333 IU may also have a negative effect on healthy birth and baby's bone development. Pregnant women should be guided by their doctors to help them stay within the range of best Vitamin A intake for their baby's health. This means obtaining adequate Vitamin A through diet and supplements while avoiding excessive Vitamin A intake.

## **Beta-Carotene May Not Adequately Substitute For Vitamin A**

SuperNutrition supplies both Vitamin A and beta-carotene in our multi-vitamin formulas because each contributes unique benefits that the other nutrient does not provide.

Vitamin A is an essential nutrient, meaning it is essential for life. Beta-carotene is not an essential nutrient. Beta-carotene is a true antioxidant, while Vitamin A (retinol) is not.

Vitamin A (retinol) has anti-microbial effects, immune system supporting effects, a role in bone health and eye health, and affects growth in the body.

Beta-carotene can provide a secondary source of Vitamin A activity; however, beta-carotene may not always convert in the body into Vitamin A (retinol) well enough to support the body's needs.

## **Beta-Carotene Conversion To Vitamin A (Retinol) Can Be Low**

Some of the beta-carotene that we consume in foods converts into Vitamin A (retinol) in the body. If there is not enough pre-formed Vitamin A available, a healthy person's body converts beta-carotene into Vitamin A to make up the difference. Increased conversion is stimulated when the body's Vitamin A (retinol) supply drops below a threshold amount. However, for some people, the conversion of beta-carotene to Vitamin A is not efficient enough to produce adequate Vitamin A blood levels. For some other people, the conversion is better but provides only marginally-adequate levels of Vitamin A (retinol) in their blood. Both groups are at risk for low serum Vitamin A (retinol).

## Beta-carotene May Not Increase The Body's Vitamin A

The rate of beta-carotene's conversion to Vitamin A (retinol) may also vary widely among different individuals. Studies have shown that supplementing with beta-carotene does not consistently increase Vitamin A (retinol) levels in the blood.<sup>3,4,18,19</sup>

Lin Y, and associates. Variability of the conversion of beta-carotene to Vitamin A in women measured by using a double-tracer study design. American Journal of Clinical Nutrition 2000 Jun;71(6):1545-54.

**Comment:** Lin's study of 11 healthy well-fed women living in a controlled environment found that only 6 out of 11 of them (55%) experienced measurable increases in their blood Vitamin A after consuming beta-carotene. There was no increase in blood Vitamin A in the other five women (45%). The authors said, "*The Vitamin A activity of  $\beta$ -carotene is variable and surprisingly low in women. The reasons for this are not well understood. The Vitamin A activity of  $\beta$ -carotene in men is still uncertain.*"

Hickenbottom SJ, and associates. Variability in conversion of  $\beta$ -carotene to Vitamin A in men as measured by using a double-tracer study design. American Journal of Clinical Nutrition 2002 May;75(5): 900-907. <http://www.ajcn.org/cgi/content/abstract/75/5/900>

**Comment:** Hickenbottom's study evaluated the Vitamin A activity of beta-carotene in eleven healthy, well-fed men living in a controlled environment and found similar results as was seen in the Lin study above with 11 women. Only 6 of 11 men experienced increased Vitamin A blood levels after consumption of beta-carotene. The authors concluded that the Vitamin A activity of beta-carotene, even when measured under controlled conditions, "*can be surprisingly low and variable.*"

Nierenberg DW, and associates. Effects of 4 y of oral supplementation with beta-carotene on serum concentrations of retinol, tocopherol, and five carotenoids. American Journal of Clinical Nutrition 1997 Aug;66(2):315-319 [david.nierenberg@dartmouth.edu](mailto:david.nierenberg@dartmouth.edu)

**Comment:** Nierenberg's four-year study of high dose (41,000 IU) beta-carotene supplementation showed a 151% increase in blood beta-carotene levels, but no significant increase in blood Vitamin A (retinol) levels, confirming what several previous studies had shown.

## Beta-Carotene Conversion: Less Than Previously Thought

Another problem with assuming that beta-carotene can substitute for Vitamin A is that the conversion factor for beta-carotene to Vitamin A may not be as efficient as it has been thought to be, and may vary widely in different people. For many years, beta-carotene had been estimated to convert into 1/6<sup>th</sup> as much Vitamin A (retinol) in healthy people.<sup>2,20</sup> (6 mg of beta-carotene would convert to 1 mg of Vitamin A)

Recently, researchers have been questioning the estimate of the 6-to-1 conversion ratio of beta-carotene to Vitamin A. Their studies have suggested the beta-carotene conversion in many people may be as low as 20 to 1.<sup>21,22,23,24</sup> If these studies are correct, vegetarians, especially vegans, may be getting less than one-third as much Vitamin A from beta-carotene as was believed.

## The Six Major Risk Groups for Vitamin A Deficiency

Although studies show that many millions of people adequately convert dietary beta-carotene to Vitamin A in their bodies, there are also many millions of people who do not convert beta-carotene well enough to satisfy the body's need for Vitamin A. People in these groups are at risk for Vitamin A deficiency and should consider supplementing pre-formed Vitamin A (retinol). The five major groups at risk for Vitamin A deficiency are:

1. People in Third World Countries
2. American urban women and men
3. Pregnant women
4. Women with marginal or acute hypothyroidism
5. Children
6. Vegans

### Third World Countries

The following study investigated Vitamin A deficiency in developing countries. In some parts of the world even though beta-carotene is found abundantly in the diet, when there is little Vitamin A (retinol) in the diet, Vitamin A deficiency occurs.

Solomons NW, and associates. Plant sources of provitamin A and human nutriture. *Nutrition Reviews* 1993 Jul;51(7):199-204.

**Comment:** The study above from scientists in Guatemala, looked at Vitamin A deficiency and beta-carotene intake and stated that developing countries should not expect beta-carotene from food sources to enable the body to maintain adequate Vitamin A stores.

They said, *"Evidence from feeding studies shows an almost universally poorer uptake of intact carotenoids from plant sources as opposed to pure [retinol] sources. With notable exceptions, the bioconversion of plant carotenoids to pre-formed (retinol) Vitamin A also seems to be inefficient."* The study's authors also said, *"The accepted 6:1 equivalency of beta-carotene to pre-formed Vitamin A must be challenged and reexamined in the context of dietary plants. The consequences of operating on a miscalculation could be serious indeed for public health programs designed to alleviate and eradicate hypovitaminosis A."* (Hypovitaminosis A means Vitamin A deficiency.)

Although Vitamin A deficiency occurs significantly less often in the United States, there are some individuals in the U.S. with similar Vitamin A deficiency problems (as noted below).

### Women (and Men) Generally May Also Be At Risk

In the studies by Lin and Hickenbottom on page 4, nearly 50% of both women and men (5 out of 11 each) were not able to convert beta-carotene to Vitamin A adequately.

In a study of 72,337 postmenopausal American women, the total daily Vitamin A (retinol) intake from food ranged from as low as about 800 IU to a high of about 2600 IU, with a mid-range of about 1550 IU, increasing up to 1750 to 2050 IU in the upper ranges of Vitamin A intake.<sup>4</sup>

- 1550 IU is 758 IU (33%) lower than the RDA for women (2333 IU).
- 1750 IU is 588 IU (25%) lower than the RDA for women.
- 2050 IU is 288 IU (12%) lower than the RDA for women.

This study indicated that almost half of American women may experience frank or marginal Vitamin A deficiency unless they supplement with Vitamin A. A daily multi-vitamin with 500 IU of Vitamin A may help over half of American women stay close to the RDA and within the potential range for optimal bone density, without exceeding the safe and effective limit for best bone density. This concern extends to American men, who have similar diets as women and similar beta-carotene conversion problems.

## Women: Hypothyroidism May Lead to Vitamin A Deficiency

Beta-carotene's conversion into Vitamin A (retinol) can be highly inefficient in people with certain health problems, most specifically, people who are hypothyroid.<sup>26,27</sup> This means that they have low (hypo) thyroid hormone production. Undesired weight gain, especially in the hips and legs (lower body), is one of the most common symptoms of hypothyroidism in women. The incidence is lower in men, but still somewhat common over about 40 years of age.

Aktuna D, and associates. Beta-carotene, Vitamin A and carrier proteins in thyroid diseases. *Acta Medica Austriaca* 1993;20(1-2):17-20.

**Comment:** This study stated that about 40% of women over 40 years of age have sub-clinical or overt hypothyroidism. The authors said that the conversion of beta-carotene to Vitamin A (retinol) is increased by thyroid hormone. Thus Inadequate thyroid hormone production can compromise the conversion of beta-carotene to Vitamin A (retinol). Beta-carotene blood levels were shown to be significantly higher in hypothyroid people than in healthy people, because inefficient conversion allows beta-carotene to build up in the blood, which is eventually seen as an orange tint in the skin.

If you are vegetarian and hypothyroid, you are especially likely to be deficient in Vitamin A, because pre-formed Vitamin A (retinol) is only contained in animal food products or dietary supplements. Plants do not contain pre-formed Vitamin A (retinol). (The Vitamin A found in SuperNutrition formulas is manufactured and not derived from animal products.)

## Pregnant Women In The United States May Also Be At Risk

Statistics indicate that pregnant women have approximately the same dietary habits as other women, yet they do have an increased requirement for Vitamin A intake while pregnant.<sup>2</sup> This makes them more susceptible to a Vitamin A deficiency.

Recent research has shown that in later life, postmenopausal osteoporosis can be reduced for a person by ensuring that their bones grow properly when they are still in their mother's womb.<sup>25</sup> To guarantee that serum retinol is in the optimal range during the especially sensitive time of pregnancy, it is most prudent to ask your doctor for a serum retinol test. This should be done early in pregnancy since relying on your body being able to convert enough beta-carotene to Vitamin A for your baby's proper bone development may seriously compromise your baby's bone development both in the womb and throughout life. For your baby's best health, according to the National Academy of Sciences, total Vitamin A intake from both food and supplements should not be below the RDA for pregnancy (2500 IU until 18 years of age and 2567 IU over 18 years of age).<sup>2</sup>

As stated on page 2, pregnant women should be guided by their doctors to obtain adequate Vitamin A (retinol) while also avoiding excessive Vitamin A intake.

## The World Health Organization Recommends Vitamin A (Retinol) Supplementation For A Healthy Pregnancy

Contrary to misinformation that pre-formed Vitamin A (retinol palmitate and retinol acetate) in multi-vitamin supplements is toxic to the unborn child, the World Health Organization states that supplemental Vitamin A (retinol) is critically needed for a healthy pregnancy.<sup>57</sup>

Part of this misinformation refers to scientific studies on Vitamin A, indicating that these studies show that Vitamin A (retinol) is toxic for pregnancies. However, examining these studies shows that all of them actually state that there have been no adverse effects or toxicities for pregnancy ever reported for Vitamin A (retinol) intake that is under 10,000 IU (more than 4 times higher than the RDA). We have also had questions about the claim that the World Health Organization (WHO) says Vitamin A is toxic for pregnancy. **But in fact, the World Health Organization's paper, "Safe vitamin A dosage during pregnancy and lactation", states "...there is no teratogenic risk [of birth defects] from preformed Vitamin A [retinol] supplements of 10,000 IU."**<sup>58</sup>

In a search of the National Library of Medicine, we could find no scientific studies or research that indicated any risk of birth defects from the Vitamin A levels generally found in multi-vitamins. All published studies agreed that at levels less than 10,000 IU of supplemental Vitamin A (retinol), there is no risk of birth defects. Furthermore, the Center for Disease Control has no reports of any birth defects associated with Vitamin A in the amounts found in multi-vitamins.

This is of special concern since pregnancy is a very sensitive time for the baby and even a slight deficiency of Vitamin A can affect the child not only during its birth and infancy, but also into adulthood. To ensure healthy pregnancies, the U.S. Government has set Recommended Daily Allowances for Vitamin A for pregnancy at 2500 IU up to 18 years old and 2567 IU thereafter.<sup>2</sup>

## Children May Also Be At Risk – Around the World and in the US

Studies show that millions of children throughout the world whose only source of Vitamin A is Vitamin A's precursor, beta-carotene, do indeed have adequate levels of Vitamin A (retinol) in their blood for normal health. There is adequate beta-carotene in their diets and the conversion of beta-carotene in their bodies is efficient enough to satisfy their need for Vitamin A. But there are also millions of children who do not have adequate Vitamin A blood levels because they do not obtain enough beta-carotene from their diets or they do not convert beta-carotene to Vitamin A adequately.

### Children In Third World Countries

Vitamin A deficiency and associated health problems are much more common in developing countries where overall nutrition is poor, and one study stated, "*Clinical trials... indicate that young children in developing counties cannot achieve normal vitamin A status from plant diets alone.*"<sup>28</sup>

Zagre NM, and associates. Changes in Vitamin A intake following the social marketing of red palm oil among children and women in Burkina Faso. *Sante* 2002 Jan-Mar;12(1):38-44.

**Comment:** The 30-month study above looked at 210 mothers and their children in Burkina Faso, Africa. Because of impoverished conditions, Vitamin A deficiency is a “*major public hazard.*” The children were 1 to 3 years old when the study began. Because 90 percent of the dietary intake of Vitamin A sources came from beta-carotene from plants such as fruits and dark green leafy vegetables, 64% of the mothers and 85% of the children had low blood Vitamin A (retinol) levels.

Numerous studies of children state that reliance on beta-carotene alone for the body’s Vitamin A needs can compromise Vitamin A status.<sup>3,4,18,19,21,22,23,24</sup> Studies of these children show associations with low blood Vitamin A (retinol) and increased potential for hearing loss,<sup>14</sup> night blindness and eye diseases<sup>6,7,8,29</sup> respiratory infections such as pneumonia, diarrhea and an increased potential to contract disease like measles<sup>12</sup> and anemia,<sup>30</sup> as well as bone growth abnormalities<sup>11</sup>; and even death.<sup>11</sup> Adequate blood Vitamin A is required for the production of growth hormone in the body, and a Vitamin A deficiency can cause stunted growth in children.<sup>12</sup> Furthermore, even sub-clinical Vitamin A deficiency can increase the risk of preterm (early) delivery of the baby.<sup>30</sup>

Rosen DS, and associates. Vitamin A deficiency and xerophthalmia in western Yemen. European Journal of Clinical Nutrition 1996 Jan;50(1):54-7. Helen Keller International New York.

**Comment:** The study above detailed Vitamin A (retinol) deficiency in children in Yemen who had symptoms such as xerophthalmia (abnormal dryness of the eye due to a deficiency of tears), followed by trachoma (chronic eye infection characterized by granulations and scarring of the cornea), night blindness, ulceration of the cornea of the eye, and Bitot’s spots on the cornea. Their dietary Vitamin A came mostly from food sources of beta-carotene.

Rahman MM, and associates. Administration of 25,000 IU Vitamin A doses at routine immunization in young infants. European Journal of Clinical Nutrition 1995 Jun;49(6):439-445.

**Comment:** The double-blind, placebo-controlled study above looked at 25,000 IU of Vitamin A (retinol) given once per month to newborns in India and determined that was not enough to reduce health problems.

Humphrey J, and associates. Neonatal Vitamin A supplementation: effect on development and growth at 3 years of age. American Journal of Clinical Nutrition 1998;68:109-117.

**Comment:** The study above stated that Vitamin A deficiency is a “*major public health problem throughout the developing world affecting an estimated 124 million young children and accounting for more than 1 million child deaths each year.*”

When 50,000 IU of Vitamin A as retinol palmitate was given to infants on the first day of life, after one year there was a 64% reduction in infant mortality and an over 50% reduction in symptoms of pneumonia, a leading cause of child death.

## Children In The Western World

While the Vitamin A deficiency experienced by children in Third World countries is not seen as much in the United States, some children in the U.S do have problems with getting enough Vitamin A, either pre-formed Vitamin A (retinol) or as pro-vitamin A (beta-carotene). Therefore, Vitamin A deficiency syndromes do also occur in children in the United States. The next study of 20 children in Long Beach, California who suffered from measles found that 50 percent were deficient in Vitamin A (retinol).

Arrieta AC, and associates. Vitamin A levels in children with measles in Long Beach, California. Journal of Pediatrics 1992 Jul;121(1):75-78.

**Comment:** The authors noted: *“Studies from Africa suggest that vitamin A supplementation may reduce morbidity and mortality rates associated with measles among poorly nourished children. We studied 20 children with measles in Long Beach, Calif., and found that 50% were vitamin A deficient. This frequency among presumably well nourished American children supports evaluation of vitamin A status as a part of acute management of measles in the United States.”*

Caballero B, and associates. Low serum retinol is associated with increased severity of measles in New York City children. Nutrition Reviews 1992 Oct;50(10):291-292.

**Comment:** The Caballero study above in New York City found an association with Vitamin A deficiency and severity of measles. The authors said, *“...decline in circulating [blood] retinol was associated with increased duration of fever, higher hospitalization rates, and decreased antibody titers.”*

While the above studies deal specifically with measles and low blood Vitamin A (serum retinol) in children in the United States, they do indicate the possibility that other health conditions in children may be associated with blood Vitamin A (retinol) levels.

Evain-Brion D, and associates. Vitamin A deficiency and nocturnal growth hormone secretion in short children. Lancet 1994 Jan 8;343(8889):87-88.

**Comment:** The study above looked at pre-pubertal short children in France who had low nighttime growth hormone secretion which can cause the child to not grow to their full potential height. Blood measures of Vitamin A and total dietary Vitamin A were significantly lower in short children with low night time growth hormone secretion than in normal children or in naturally short children. Nine out of twelve of the children with low nighttime growth hormone secretion experienced increased nighttime growth hormone secretion when supplemented with 10,000 IU of Vitamin A (retinol) per day for 3 months.

If there are concerns with immune function, bone growth, or short stature or growth problems we suggest that you work with your doctor to ensure that your child’s serum retinol is in the optimal range.

## Vegans May Also Be At Risk

There are relatively few scientific studies on the dietary intake and the bone mineral density of vegetarians who consume some animal products like milk or eggs, and even fewer on the dietary intake and bone mineral density of vegans (vegetarians that consume no animal products).

Of the twelve studies we were able to locate in a search of the National Library of Medicine archives that compared Vitamin A intake between vegans, vegetarians and non-vegetarians,

Five were studies of vegetarians from the US, France and Great Britain that found that vegetarians and non-vegetarians in the studies both tended to have the same general range of self-reported Vitamin A intake when beta-carotene was included as a Vitamin A source.<sup>31,32,33,34,35</sup>

Two other studies of vegetarians and non-vegetarians reported that the vegetarians in the studies had higher intakes of Vitamin A than the non-vegetarians.<sup>36,37</sup>

Two other studies involving vegans, vegetarians and non-vegetarians, found that all had the same general range of self-reported Vitamin A intake, but that vegans tended to be in the lower end of acceptable.<sup>38,39</sup>

Two other studies involving vegans and non-vegetarians, reported that vegans had higher self-reported Vitamin A intake than non-vegetarians.<sup>40,41</sup>

One study however, reported that non-vegetarians had a higher reported intake of Vitamin A than did vegans.<sup>42</sup>

Together, these studies indicate that vegans have the same general range of Vitamin A intake as other vegetarians and non-vegetarians, but that they may tend to be slightly on the low side.

### **Beta-Carotene-to-Vitamin A Conversion Ratio Accuracy Questioned**

There is a major concern about the accuracy of the conversion rate used to calculate the Vitamin A derived from the beta-carotene intake of vegans. Other than the pre-formed Vitamin A vegans get from supplements, they obtain all their Vitamin A (retinol) from the conversion of beta-carotene to Vitamin A in their bodies. The accuracy of the conversion rate used in scientific calculations is being questioned by researchers with the concern that the conversion rate may be significantly lower than previously thought. (See pages 3 and 4.) If this proves to be true, it is of special concern for vegetarians who are vegans.

While vegetarians may eat milk or egg products and obtain some pre-formed Vitamin A (retinol) from these sources, vegans are vegetarians who do not eat animal products of any kind, so they do not obtain any pre-formed Vitamin A (retinol) from their diets. The studies above showed the calculated vegan beta-carotene intake to be adequate, even high, and in the same range as or even higher than non-vegetarians and other types of vegetarians. But if the conversion rate is actually lower, vegan Vitamin A intake will be recalculated at somewhat less than non-vegetarians and other vegetarians (both of whom get some pre-formed Vitamin A [retinol] in their diets).

### **The Concern About Bone Density For Vegans**

While a recalculation of Vitamin A intake may change some numbers and is important, it will not appreciably change how vegetarians eat. Since absorption, availability and conversion of beta-carotene to Vitamin A vary widely between individuals, generalized estimates may not tell the true story of the Vitamin A activity produced from beta-carotene intake for any one person. The more important consideration is how does vegan bone mineral density compare with the bone mineral density of non-vegetarians and other vegetarians.

Of the twelve studies on vegetarian bone mineral content, mass and densities that were located in our search of the National Library of Medicine archives,

One study reported that vegetarians between 53 and 79 years of age had better bone mineral content than non-vegetarians.<sup>43</sup>

One study reported that male vegetarians and non-vegetarians between 20 and 79 years of age had about the same bone mineral mass.<sup>44</sup>

One study reported there was no significant difference in bone mineral content between premenopausal vegetarians and non-vegetarians.<sup>45</sup>

Another study reported there was no significant difference in bone mineral content between older female vegetarians and non-vegetarians.<sup>46</sup>

Three other studies reported there was no significant difference in bone mineral density between postmenopausal vegetarians and non-vegetarians.<sup>47,48,49</sup>

Yet another study reported there was no significant difference in bone mineral density between premenopausal vegans, other vegetarians and non-vegetarians.<sup>50</sup>

Another study found that elderly female vegans and vegetarians had lower bone density at some bone sites than non-vegetarians.<sup>51</sup>

Two studies (one a 10 year follow-up of the first) found that older vegetarian women lose less bone mass than non-vegetarians.<sup>52,53</sup>

And one study found that long-term vegans had about 2½ times greater risk of fractures than non-vegetarians.<sup>54</sup>

In summary, of the 12 studies,

- 1 found that older vegetarians have higher bone density than non-vegetarians.
- 6 found no differences in either bone mineral mass, content or density between adult women or men vegetarians and non-vegetarians.
- 1 found no differences in bone density between vegans, other vegetarians and non-vegetarians.
- 1 found vegans and vegetarians have less bone mass than non-vegetarians.
- 2 found older vegetarians lose less bone mass than non-vegetarians.
- 1 found that vegans have about 2½ times the risk of fractures as non-vegetarians.

While these are relatively few studies, they do represent a small cross section of women and men from both the U.S. and around the world. Though the statistical evidence is not strong with so few studies, it does indicate that vegans tend to have slightly lower bone density than non-vegetarians and other vegetarians, but that they, like other vegetarians, tend to lose bone more slowly than non-vegetarians, and that vegans do run higher risks of fractures than non-vegetarians. Since, once vegans have achieved a bone density level, they may tend to lose the bone density more slowly than non-vegetarians, the concern here is to increase bone density to a safe level.

In these cases of acceptable but slightly lower bone density, minor problems in the body with the beta-carotene conversion to Vitamin A can cause vegans to experience borderline Vitamin A deficiency problems. For vegans, moderate supplementation with pre-formed Vitamin A (retinol) can be insurance for long-term good health.

## **Why Does SuperNutrition Include Vitamin A In Our Formulas?**

Vitamin A (retinol), as an essential nutrient, is necessary for life itself. (“Vitamins” by definition, are necessary for life.)

SuperNutrition includes Vitamin A (retinol) in our daily vitamin formulas as insurance for the groups of people who may be at risk for Vitamin A deficiency diseases.

1. Pregnant women may not obtain the RDA of pre-formed Vitamin A (retinol) from their diets, or not get enough pro-vitamin A (beta-carotene) or both. Some pregnant women may have a problem with inadequate conversion of beta-carotene into Vitamin A. Recent research has shown that women with good bone density during their teens have less osteoporosis after menopause.<sup>55</sup> However, good bone health begins even sooner than that. Recent

research shows that strong bone formation of the baby during pregnancy will protect bone health throughout life and after menopause.<sup>56,57</sup> Vitamin A (retinol) insurance obtained from dietary supplements will help mothers-to-be feel confident that they are doing everything possible for their baby's future health, especially their baby's bones and immune system.

2. Many people do not obtain the RDA of Vitamin A (retinol) from their diet, either because they do not obtain enough pre-formed Vitamin A (retinol) in their diets, or not enough pro-vitamin A (beta-carotene), or both.
3. Many people do not convert beta-carotene into Vitamin A in their bodies adequately no matter how much beta-carotene they get from their food.
4. Four out of ten women over 40 are hypothyroid or borderline hypothyroid and may not adequately convert beta-carotene into Vitamin A. This applies to hypothyroid men also.
5. Although Vitamin A deficiencies are generally not thought to be common in the US, some studies indicate that as much as half the US population is at risk of having a borderline or acute Vitamin A deficiency.
6. Some vegans may need supplementation to get adequate levels of Vitamin A in their bodies. Supplemental pre-formed Vitamin A (retinol) can provide valuable nutritional insurance.

## Proper Vitamin A Supplementation Is Good Nutritional Insurance

Scientists and doctors agree that if you obtain the RDA of Vitamin A (retinol) from your diet you do not need Vitamin A supplementation. However, the above studies show that millions of Americans, including meat eaters and vegetarians are at risk for Vitamin A deficiency. Appropriately dosed pre-formed Vitamin A (retinol) in supplements is safe, effective and prudent nutritional insurance.

## How Can You Tell If You Are Vitamin A Deficient?

Ask your doctor to measure your Vitamin A (retinol) blood level. The lab test will tell you if your measurement is within the best range.

If your serum retinol is "out of range", a food-frequency questionnaire (also called a dietary analysis) can help you discover where your diet can be adjusted to bring your serum retinol into normal range.

*The statements in this report have not been evaluated by the Food and Drug Administration. They are not meant to diagnose, treat, cure or prevent any disease, and are not meant to substitute for the advice of your physician.*

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6. The Truth About Vitamin A (Retinol) and Beta-Carotene
7. Safety and Effectiveness of Selenomethionine, Selenite and "Food-Grown-Type" Selenium

## References

1. Sklan D. *Vitamin A in human nutrition*. Progressive Food and Nutrition Sciences 1987;11(1):39-55.
2. Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc*. Nation Academies Press <http://books.nap.edu/books/0309072794/html/82.html>
3. Promislow JE and associates. *Retinol intake and bone mineral density in the elderly: The Rancho Bernardo Study*. Journal of Bone and Mineral Research 2002;17(8):1349-1358.
4. Feskanich D and associates. *Vitamin A intake and hip fractures among postmenopausal women*. Journal of the American medical Association (United States), Jan 2, 2002, 287(1):47-54.
5. Sibulesky L and associates. *Safety of <7500 RE (<25000 IU) Vitamin A daily in adults with retinitis pigmentosa*. American Journal of Clinical Nutrition (United States) 1999 Apr; 69(4):656-663.
6. Bloem MW and associates. The role of universal distribution of Vitamin A capsules in combating Vitamin A deficiency in Bangladesh. Journal of Epidemiology 1995 Oct 15;142(8): 843-855.
7. Rayner RJ and associates. Night blindness and conjunctival xerosis caused by Vitamin A deficiency in patients with cystic fibrosis. Archives of Diseases of Children 1989 Aug;64(8):1151-1156.
8. Christian P and associates. Vitamin A or beta-carotene supplementation reduces but does not eliminate night blindness in Nepal. Journal of Nutrition 1998 Sept;127(9):1458-1463.
9. Stewart-Truswell A. *Malnutrition in the Third World – II*. British Medical Journal 1985;291:587-588.
10. Pastorino U and associates. *Safety of high-dose Vitamin A. Randomized trial on lung cancer chemoprevention*. Oncology (Switzerland) 1991; 48(2):131-137.
11. Azais-Braesco V and associates. *Vitamin A in pregnancy: requirements and safety limits*. American Journal of Clinical Nutrition 2000 May;71(5 Suppl):1325S-233S. [braesco@clermont.inra.fr](mailto:braesco@clermont.inra.fr).
12. Evain-Brion D and associates. *Vitamin A deficiency and nocturnal growth hormone secretion in short children*. The Lancet 1994;343:87-88.
13. Rothman JK and associates. *Teratogenicity of high vitamin A intake*. New England Journal of Medicine 1995 Nov 23;333:1369-1373.
14. Gerster H. *Vitamin A—functions, dietary requirement and safety in humans*. International Journal for Vitamin and Nutrition Research 1997;67(2):71-90.
15. State of California, Environmental Protection Agency *Proposition 65*. <http://www.oehha.ca.gov/prop65/law/p65.html>.
16. Weigand UW and associates. *Safety of Vitamin A: recent results*. International Journal of Vitamin and Nutrition Research 1998;68(6):411-416.
17. Miller RK and associates. *Periconceptual Vitamin A use: how much is teratogenic?* Reproductive Toxicology 1998 Jan-Feb;12(1):75-88.
18. Zagre NM and associates. *Changes in Vitamin A intake following the social marketing of red palm oil among children and women in Burkina Faso*. Sante 2002 Jan-Mar;12(1):38-44.
19. Nirenberg DW and associates. *Effects of  $\gamma$  4 of oral supplementation with beta-carotene on serum concentrations of retinol, tocopherol, and five carotenoids*. American Journal of Clinical Nutrition 1997 AUG;66(2):315-9.
20. Olson JA. *Bioavailability of carotenoids*. Archives of Latinoamerican Nutrition 1999 Sep;49(3 Suppl 1):21S-25S.
21. Solomons, NW. *Plant sources of proVitamin A and human nutriture: How much is still too little?* Nutrition Reviews 1999 Nov;57(11):350-361.
22. Tang G and associates. *Vitamin A equivalence of beta-carotene in a woman as determined by a stable isotope reference method*. European Journal of Nutrition 2002 Feb;39(1):7-11.
23. Brubacher GB and associates. *The Vitamin A activity of beta-carotene*. International Journal of Vitamin and Nutrition Research 1985;55(1):5-15.
24. Hickenbottom SJ. *Dual isotope test for assessing beta-carotene cleavage to Vitamin A in humans*. European Journal of Nutrition 2002 Aug;41(4):141-147.
25. Javadi MK and Cooper C. *Prenatal and childhood influences on osteoporosis*. Best practice and research. Clinical endocrinology and metabolism. 2002 Jun;16(2):349-67.
26. Mandal SK and associates. *Carotene and retinol levels in the diagnosis of hypothyroidism*. Journal of the Association of Physicians of India 1985 Oct;33(10):654-655.
27. Aktkuna D and associates. *Beta-carotene, vitamin A and carrier proteins in thyroid processes*. Acta Medica Austriaca 1993;20(1-2):17-20.
28. Somner A. *Assessment and control of Vitamin A deficiency: the Annency Accords*. Journal of Nutrition 2002 Sep;132(9 Suppl):2845S-2850S.
29. Rosen DS and associates. *Vitamin A deficiency and xerophthalmia in western Yemen*. European Journal of Clinical Nutrition 1996 Jan;50(1):54-7.
30. Radhika MS and associates. *Effects of Vitamin A deficiency during pregnancy on maternal and child health*. British Journal of Gynecology 2002 Jun;109(6):689-93.
31. Thane CW and Bates CJ. *Dietary intakes and nutrient status of vegetarian preschool children from a British national survey*. Journal of Human Nutrition Dietetics 2000;13:149-62.
32. Millet and associates. *Nutrient intake and vitamin status of healthy French vegetarians and nonvegetarians*. American Journal of Clinical Nutrition 1989;50:718-27.
33. Nathan I and associates. *The dietary intake of a group of vegetarian children aged 7-11 years compared with matched omnivores*. British Journal of Nutrition 1996;75:533-544.
34. Barr SI and Broughton TM. *Relative Weight, Weight Loss Efforts and Nutrient Intakes among Health-Conscious Vegetarian, Past Vegetarian and Nonvegetarian Women Ages 18-50*. Journal of the American College of Nutrition 2000;19(6):781-788.
35. Donovan UM and Gibson RS. *Dietary intakes of adolescent females consuming vegetarian, semi-vegetarian, and omnivorous diets*. Journal of Adolescent Health 1996 Apr;18(4):292-300.
36. Neiman DC and associates. *Dietary status of Seventh-Day Adventist vegetarian and non-vegetarian elderly women*. Journal of American Dietetics 1989 Dec;89(12):1763-69.
37. Hunt IF and associates. *Food and nutrient intake of Seventh-day Adventist women*. American Journal of Clinical Nutrition 1988;48:850-51.
38. Draper A and associates. *The energy and nutrient intakes of different types of vegetarian: a case for supplements*. British Journal of Nutrition 1993;69:3-19.
39. Calkins BM and associates. *Diet, nutrition intake, and metabolism in populations at high and low risk for colon cancer*. American Journal of Clinical Nutrition 1984 Oct;40:896-905.
40. Rauma A and associates. *Antioxidant status in long-term adherents to a strict uncooked vegan diet*. American Journal of Clinical Nutrition 1995;62:1221-7.
41. Janelle RC and associates. *Nutrient intakes and eating behavior scores of vegetarian and nonvegetarian women*. Journal of the American Dietetic Association 1995 Feb;95(2):180-89.
42. Lasson CL and Johansson GK. *Dietary intake and nutritional status of young vegans and omnivores in Sweden*. American Journal of Clinical Nutrition 2002;76:100-106.
43. Ellis FR and associates. *Incidence of osteoporosis in vegetarians and omnivores*. American Journal of Clinical Nutrition 1972 Jun;25(6):555-8.
44. March AG and associates. *Bone mineral mass in adult lacto-ovo-vegetarian and omnivorous males*. American Journal of Clinical Nutrition 1983 Mar;37(3):453-6.
45. Lloyd T and associates. *Urinary hormonal concentrations and spinal bone densities of premenopausal vegetarian and nonvegetarians women*. American Journal of Clinical Nutrition 1991 Dec;54(6):1995-10.
46. Hunt IF and associates. *Bone mineral content of postmenopausal women: comparison of omnivores and vegetarians*. American Journal of Clinical Nutrition 1989;50:517-23.
47. Tylavsky FA and Anderson JJ. *Dietary Factors in bone health of elderly lacto-ovo-vegetarian and omnivorous women*. American Journal of Clinical Nutrition 1988 Sep;48(3 Suppl):842-9.
48. Reed JA and associates. *Comparative changes in radial-bone density of elderly female lacto-ovo-vegetarians in omnivores*. American Journal of Clinical Nutrition 1994 May;59(5 Suppl):1197S-1202S.
49. Tesar R and associates. *Axial and peripheral bone density and nutrient intakes of postmenopausal vegetarian and omnivorous women*. American Journal of Clinical Nutrition 1992 Oct;56(4):699-704.
50. Barr SI and associates. *Spinal bone mineral density in premenopausal vegetarian and nonvegetarians: cross-sectional and prospective comparisons*. Journal of the American Dietetics Association 1998 Jul;98(7):760-5.
51. Lau EMC and associates. *Bone mineral density in Chinese elderly female vegetarians, vegans, lacto-vegetarians and omnivores*. European Journal of Clinical Nutrition 1998;52:60-64.
52. March AG and associates. *Cortical bone density of adult lacto-ovos-vegetarian and omnivorous women*. Journal of the American Dietetic Association 1980 Feb;76(2):148-51.
53. March AG and associates. *Vegetarian lifestyle and bone mineral density*. American Journal of Clinical Nutrition 1988 Sep;48(3 Suppl):837-41.
54. Chiu F and associates. *Long-Term Vegetarian Diet and bone Mineral Density in Postmenopausal Taiwanese Women*. Calciferous Tissue International 1997;60:245-249.
55. Weaver SM and associates. *Adolescent nutrition in the prevention of postmenopausal osteoporosis*. Journal of Clinical Endocrinology and Metabolism 1999 Jun;84(6):1839-43.
56. Cooper C and associates. *The fetal origins of osteoporotic fracture*. Calciferous Tissue International 2002 May;70(5):391-4.
57. Jones G and associates. *Maternal diet during pregnancy is associated with bone mineral density in children: a longitudinal study*. European Journal of Clinical Nutrition 2000 Oct;54(10):749-56.
58. World Health Organization Micronutrient Initiative. *Safe vitamin a dosage during pregnancy and lactation*. World Health Organization 1998 WHO/Nut/98.4.

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